SHARP OPTONICA

SERVICE MANUAL

Refer to the additional
issue "TECHNICAL GUIDE"

ATSM080149TUN

ELECTRONIC TUNING
PROCESSOR

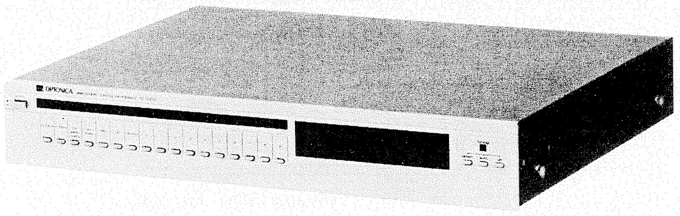
MODEL

ST-5200H

(Silver Panel)

ST-5200HB

(Brown Panel)



(PHOTO: ST-5200H)

In the interests of user-safety the set should be restored to its original condition and only parts identical to those specified be used:

INDEX TO CONTENTS

1. SPECIFICATIONS 2
2. FEATURES 2
3. SCHEMATIC DIAGRAM
    Linear Circuit,
    Power Supply Circuit, Main Digital Circuit
    and Frequency Display Digital Circuit ...... 3～4
    Front Operation Circuit (Keyboard Matrix),
    Tuning Frequency Display/Signal
    Strength Indicator .... 7～8
4. WIRING SIDE OF P.W. BOARD
    Linear Circuit, Power Supply Circuit,
    Main Digital Circuit and Frequency
    Display Digital Circuit .... 5～6
    Front Operation Circuit (Keyboard Matrix),
    Tuning Frequency Display/Signal
    Strength Indicator .... 9～10
5. TABLE 1 AC POWER SUPPLY CORD
    WIRING CONNECTION,
    AC SUPPLY VOLTAGE SELECTION 11
6. DISASSEMBLY 12
7. REPLACEMENT PARTS LIST .... 13～21

SHARP CORPORATION OSAKA, JAPAN

SPECIFICATIONS

GENERAL DESCRIPTION

Power Source:	AC 110/220/240 V, 50/60 Hz
Power Consumption:	15 W
Semiconductors:	1-Microprocessor 12-ICs (Intergrated Circuirt) 1-FET (Dual Gate, MOS type) 3-FETs (Junction type) 55-Transistors 75-Diodes (With 7-variable capacitance diodes) 6-Zener Diodes 18-LEDs and 1-LED Array Unit
Dimensions:	Width; 430 mm (16-15/16 inches) Height; 75 mm (2-31/32 inches) Depth; 393 mm (15- 1/ 2 inches) Weight; 5 kg (11 ibs)

FM

Tuning Range:	87,6 to 108 MHz
IF:	10.7 MHz
Scan Frequency:	50 kHz
Sensitivity:	1.3 μV (at S/N 26 dB, 40 kHz deviation, 75 ohms) 1.6 μV (at S/N 26 dB, 40 kHz deviation, 300 ohms)
Frequency Response:	30 to 15000 Hz ± 3 dB
Image Rejection:	75 dB (at 98 MHz)
IF Rejection:	75 dB (at 98 MHz)
Selectivity:	45 dB (22.5 kHz deviation, ±300 kHz)
Capture Ratio:	2.5 dB
AM Suppression:	50 dB
S/N:	66 dB
Distortion:	Mono; 0.2% Stereo; 0.3%
Stereo Separation:	40 dB (at 1 kHz)
FM Output Voltage:	350 mV (40 kHz deviation)

MW/LW

Tuning range:	MW;	522 ~ 1611 kHz
	LW;	145 ~ 372 kHz
IF:	450 kHz	
Scan Frequency:	1 kHz (Manual Tuning) 9 kHz (Automatic Tuning)	
Quieting Sensitivity:	MW;	350 μV/m
	LW;	350 μV/m
Image Rejection:	MW;	40 dB (at 1000 kHz)
	LW;	35 dB (at 340 kHz)
IF Rejection:	MW;	40 dB (at 1000 kHz)
	LW;	32 dB (at 340 kHz)
Distortion:	1.5%	
Output Voltage:	200 mV (400 Hz, 30% Modulation)	

Specifications are subject to change without prior notice.

FEATURES

Quartz PLL Synthesizer Tuner

In this advanced electronic tuning system, a quartz oscillator is used to generate an extremely stable reference frequency, which is broken down into the basic frequency unit used to synthesize the local oscillator frequency. The extreme stability of the quartz frequency, the fact that only those frequencies that are multiples of the basic frequency unit used in radio broadcasting are synthesized, and the accuracy guaranteed by the phase-locked loop combine to eliminate error and drift, ensuring ultra-precise, ultra-stable reception under all conditions.

Auto Tuning System

To allow easy location of any receivable station, a microprocessor works with the synthesizer in the ST-5200H/HB to scan the selected band in the designated direction (up or down), locate the nearest station, tune it in for a few seconds, and then move on if the up or down button is not released.

Pre-set Tuning System

Microprocessor pre-set tuning system memorizing without discrepancy between entry and recall.

Advanced FM Front-end Design

Advanced FM design combines four gang variable capacitance diodes, dual gate MOS FET and differential IF Amplifier.

PLL Multiplex Decoder

Phase locked loop detector improves channel separation and distortion level is lowered.

Linear Phase Ceramic Filter

Linear phase ceramic filters improve characteristics and lower distortion level.

FM Simulated Output (AIR CHECK)

Circuitry generates 400 Hz signal tone used for presetting tape deck FM recording levels.

Digital Display

A 5 digit frequency display.

FM Muting

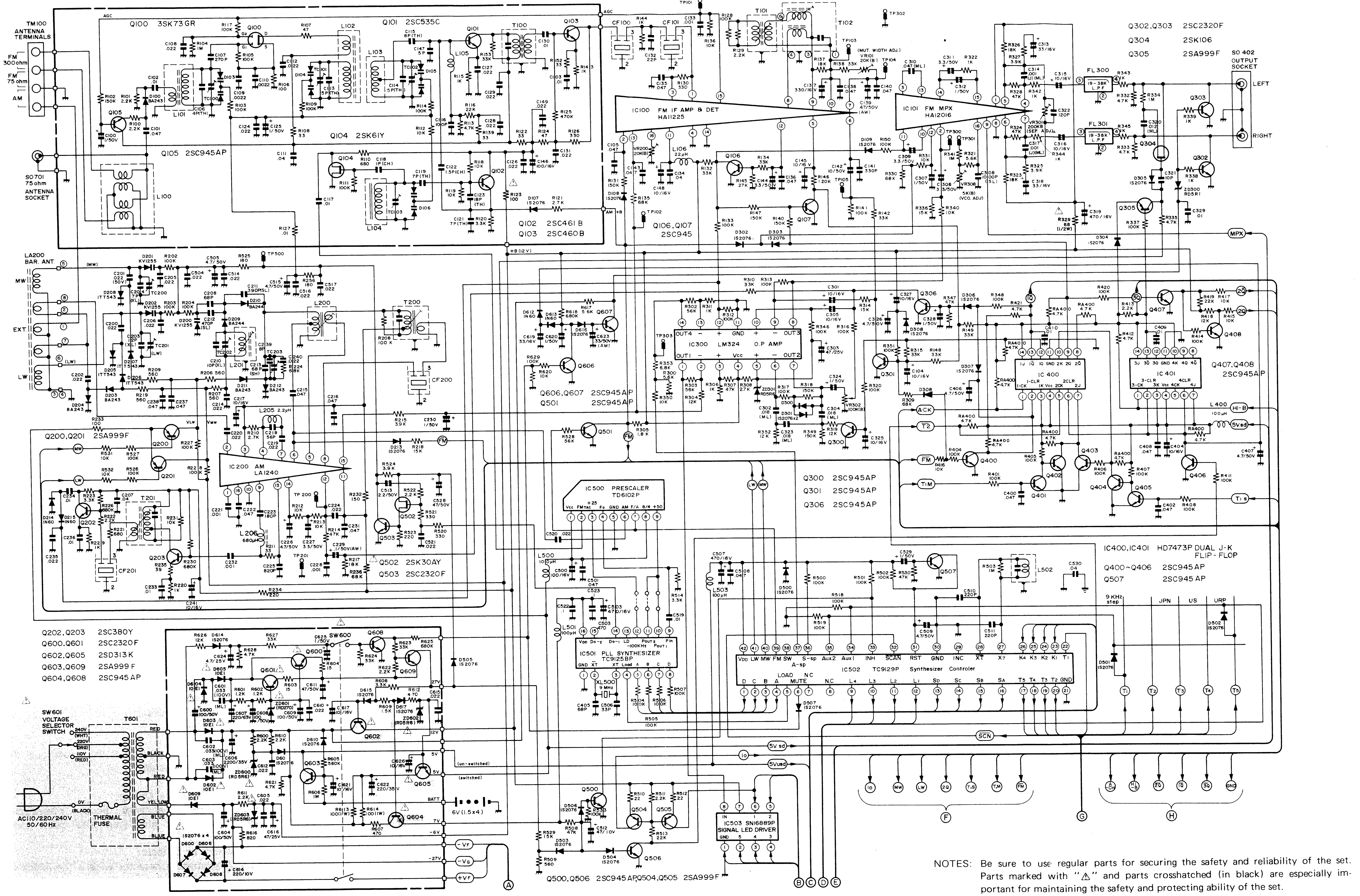
FM muting circuit eliminates the undesirable FM interstation noise while tuning.

Advanced AM Stage Design

Three variable capacitance diodes, integrated circuit, wide range ceramic filter emphasize treble component.

FM Quadrature Detector

The FM quadrature detector widens the linear region of the tuned section, and lowers distortion level.


TM100 ANTENNA TERMINALS
FM 300ohm
FM 75ohm
AM
Q100 3SK73GR
Q101 2SC535C
Q104 2SK61Y
Q105 2SC945AP
Q102 2SC461B
Q103 2SC460B
SO701 75ohm ANTENNA SOCKET
L100
LA200 BAR. ANT.
MW
EXT.
LW
IC100 FM IF AMP & DET HA11225
IC101 FM MPX HA12016
Q106,Q107 2SC945
Q302,Q303 2SC2320F
Q304 2SK106
Q305 2SA999F
SO402 OUTPUT SOCKET
LEFT
RIGHT
FL300 19-38K L.P.F
FL301 19-38K L.P.F
IC200 AM LA1240
Q200,Q201 2SA999F
Q202,Q203 2SC380Y
Q600,Q601 2SC2320F
Q602,Q605 2SD313K
Q603,Q609 2SA999F
Q604,Q608 2SC945AP
Q502 2SK30AY
Q503 2SC2320F
Q606,Q607 2SC945AP
Q501 2SC945AP
IC300 LM324 O.P AMP
Q300 2SC945AP
Q301 2SC945AP
Q306 2SC945AP
IC400 IC401
IC400,IC401 HD7473P DUAL J-K FLIP-FLOP
Q400~Q406 2SC945AP
Q407,Q408 2SC945AP
Q507 2SC945AP
IC500 PRESCALER TD6102P
IC501 PLL SYNTHESIZER TC9125BP
XL500 9MHz
IC502 TC9129P Synthesizer Controler
9KHz step
JPN
US
URP
SW601 VOLTAGE SELECTOR SWITCH
240V 220V 110V
T601
THERMAL FUSE
AC110/220/240V 50/60Hz
SW600
6V (1.5×4)
BATT
(un-switched)
(switched)
IC503 SN16889P SIGNAL LED DRIVER
Q500,Q506 2SC945AP
Q504,Q505 2SA999F
+B (12V)
-VF
-VG
+VF
A
B
C
D
E
F
G
H

NOTES: Be sure to use regular parts for securing the safety and reliability of the set. Parts marked with "⚠" and parts crosshatched (in black) are especially important for maintaining the safety and protecting ability of the set. Be sure to replace them with parts of specified part number.

(Specifications or wiring diagrams of this model are subject to change for the improvement without prior notice.)

Figure 3 SCHEMATIC DIAGRAM OF LINEAR/POWER SUPPLY/MAIN DIGITAL/FREQUENCY DISPLAY DIGITAL CIRCUIT

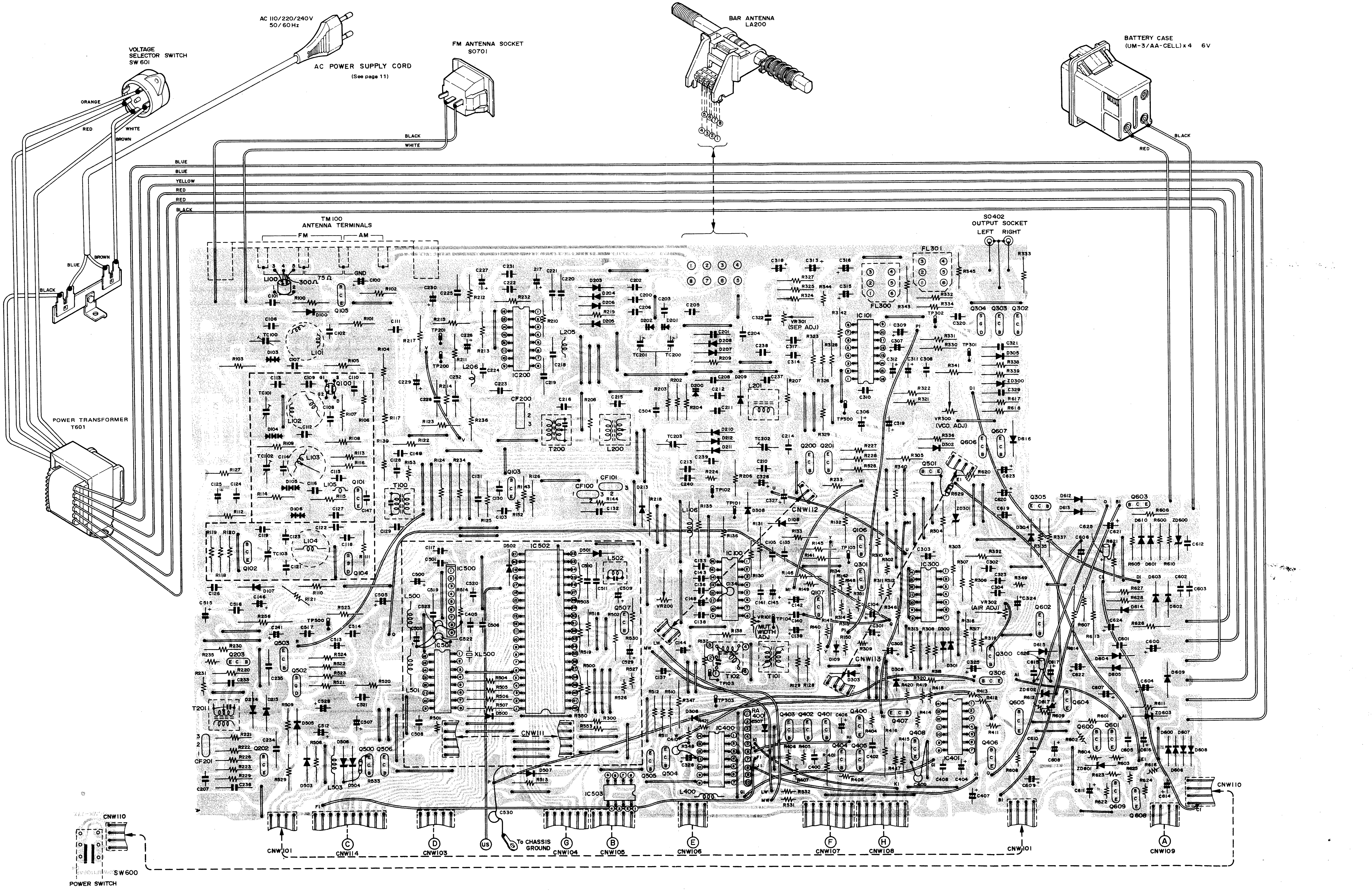
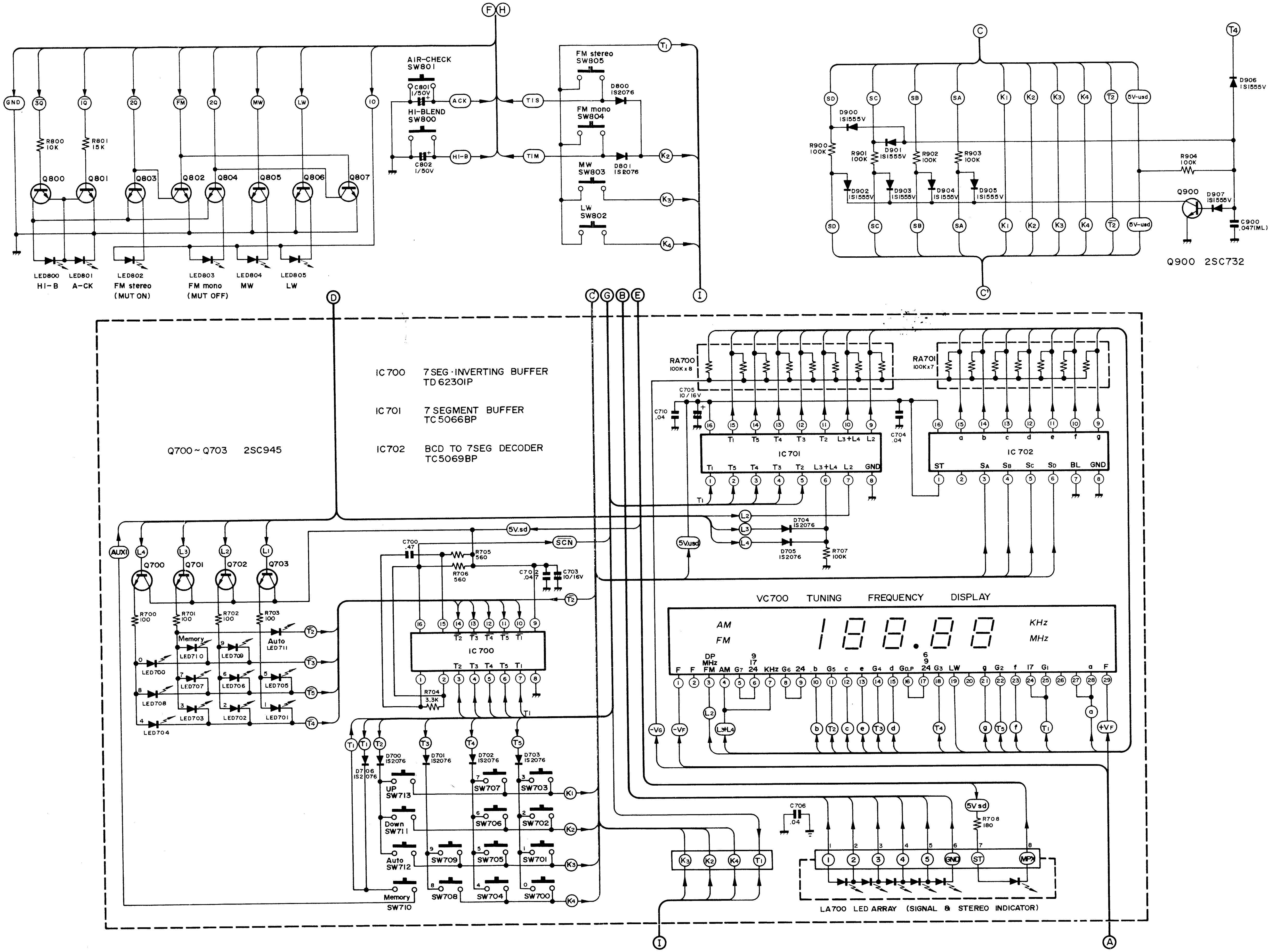

AC 110/220/240V
50/60Hz
VOLTAGE SELECTOR SWITCH SW601
AC POWER SUPPLY CORD
(See page 11)
FM ANTENNA SOCKET S0701
BAR ANTENNA LA200
BATTERY CASE (UM-3/AA-CELL)x4 6V
ORANGE
RED
WHITE
BROWN
BLACK
BLUE
BLUE
BLUE
YELLOW
RED
RED
BLACK
TM100 ANTENNA TERMINALS
FM
AM
S0402 OUTPUT SOCKET
LEFT
RIGHT
POWER TRANSFORMER T601
IC101
IC200
IC100
IC300
IC400
IC401
IC500
IC501
IC502
IC503
FL300
FL301
CF100
CF101
CF200
CF201
T100
T101
T102
T200
T201
L200
VR200
VR300 (VCO ADJ)
VR301 (SEP. ADJ)
VR302 (AIR ADJ)
VR101 (MUT WIDTH ADJ)
XL500
CNW111
CNW112
CNW113
CNW110
CNW101
CNW114
CNW103
CNW104
CNW105
CNW106
CNW107
CNW108
CNW109
To CHASSIS GROUND
SW600
POWER SWITCH

Figure 5 WIRING SIDE OF LINEAR/POWER SUPPLY/MAIN DIGITAL/FREQUENCY DISPLAY DIGITAL CIRCUIT P.W. BOARD


AIR-CHECK SW801
HI-BLEND SW800
C801 1/50V
C802 1/50V
FM stereo SW805
FM mono SW804
MW SW803
LW SW802
D800 IS2076
D801 IS2076
R800 10K
R801 15K
Q800
Q801
Q803
Q802
Q804
Q805
Q806
Q807
LED800 HI-B
LED801 A-CK
LED802 FM stereo (MUT ON)
LED803 FM mono (MUT OFF)
LED804 MW
LED805 LW
D900 IS1555V
D901 IS1555V
D902 IS1555V
D903 IS1555V
D904 IS1555V
D905 IS1555V
D906 IS1555V
D907 IS1555V
R900 100K
R901 100K
R902 100K
R903 100K
R904 100K
C900 .047(ML)
Q900 2SC732
IC700 7SEG·INVERTING BUFFER TD62301P
IC701 7 SEGMENT BUFFER TC5066BP
IC702 BCD TO 7SEG DECODER TC5069BP
Q700~Q703 2SC945
RA700 100K×8
RA701 100K×7
C705 10/16V
C710 .04
C704 .04
IC701
IC702
D704 IS2076
D705 IS2076
R707 100K
C700 .47
R705 560
R706 560
C702 .047
C703 10/16V
R700 100
R701 100
R702 100
R703 100
R704 3.3K
IC700
Memory
Auto LED711
LED710
LED709
LED700
LED707
LED706
LED705
LED708
LED703
LED702
LED701
LED704
VC700 TUNING FREQUENCY DISPLAY
AM
FM
188.88
KHz
MHz
D700 IS2076
D701 IS2076
D702 IS2076
D703 IS2076
D706 IS2076
UP SW713
Down SW711
Auto SW712
Memory SW710
SW707
SW703
SW706
SW702
SW709
SW705
SW701
SW708
SW704
SW700
C706 .04
R708 180
LA700 LED ARRAY (SIGNAL & STEREO INDICATOR)

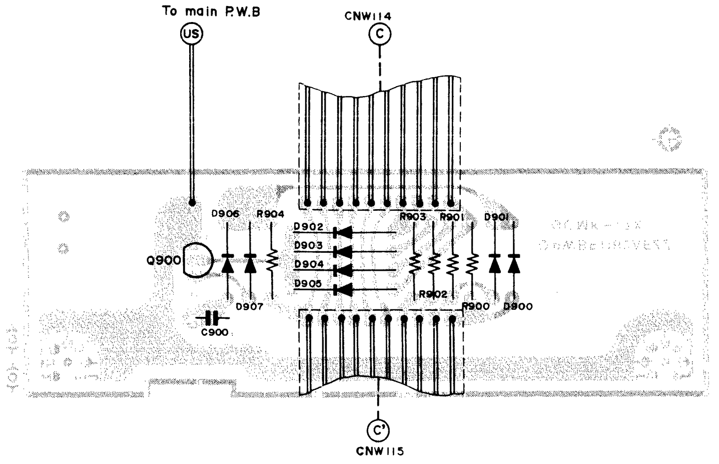
(Specifications or wiring diagrams of this model are subject to change for the improvement without prior notice.)

Figure 7 SCHEMATIC DIAGRAM OF FRONT OPERATION CIRCUIT (KEYBOARD MATRIX), TUNING FREQUENCY DISPLAY / SIGNAL STRENGTH INDICATOR AND STATION FREQUENCY

NOTES ON SCHEMATIC DIAGRAM

1. Tuning range: FM: 87.6 MHz to 108 MHz
   MW: 522 kHz to 1611 kHz
   LW: 145 kHz to 372 kHz
2. IF: FM: 10.7 MHz
   MW/LW: 450 kHz
3. Resistor: To differentiate the units of resistors, such symbols as K and M are used: the symbol K means 1000 ohm and the symbol M means 1000K ohm and the resistor without any symbol is ohm-type resistor. Besides, the one with "Fusible" is a fuse type.
4. Capacitor: To indicate the unit of capacitor, a symbol P is used; this symbol P means micro-microfarad and the unit of the capacitor without such symbol is microfarad. As to electrolytic capacitor, the expression "capacitance/withstand.
5. Switches

SWITCH NO.	FUNCTION	
SW600	Power ON/OFF	
SW700	0	Input/Pre-setting
SW701	1	Input/Pre-setting
SW702	2	
SW703	3	
SW704	4	
SW705	5	
SW706	6	
SW707	7	
SW708	8	
SW709	9	
SW710	Pre-set Station Memory	
SW711	Frequency Count-down	
SW712	Automatic Tuning	
SW713	Frequency Count-up	
SW800	High Blend	
SW801	FM Air Check	
SW802	Wave Band Selector, LW	
SW803	Wave Band Selector, MW	
SW804	Wave Band Selector, FM Mono	
SW805	Wave Band Selector, FM Stereo	


To main P.W.B
US
CNW114
C
D906
R904
Q900
D902
D903
D904
D905
R903
R901
D901
R902
R900
D900
D907
C900
C'
CNW115

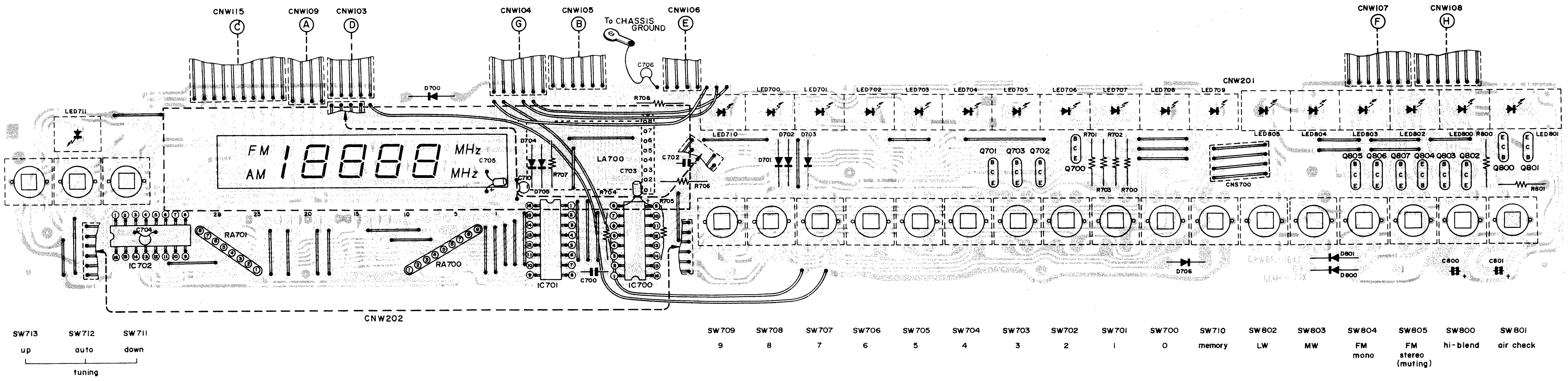
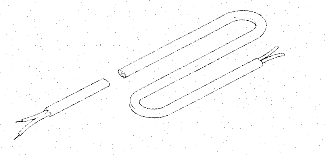
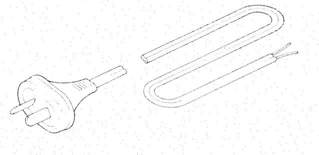
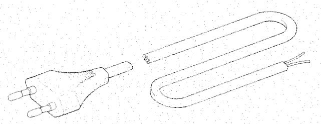
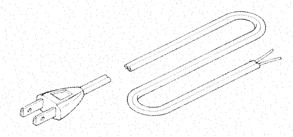
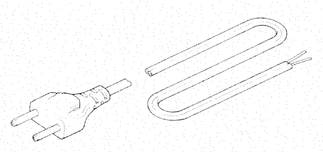

CNW115
C
CNW109
A
CNW103
D
CNW104
G
CNW105
B
To CHASSIS GROUND
CNW106
E
CNW107
F
CNW108
H
D700
C706
R708
LED711
FM
AM
18888
MHz
MHz
C705
D704
R707
D705
LA700
C703
C702
R704
R705
R706
CNW201
LED700
LED701
LED702
LED703
LED704
LED705
LED706
LED707
LED708
LED709
LED710
D702
D703
D701
Q701
Q703
Q702
Q700
R701
R702
R703
R700
LED805
LED804
LED803
LED802
LED800
R800
LED801
Q805
Q806
Q807
Q804
Q803
Q802
Q800
Q801
R801
CNS700
RA701
RA700
C704
IC702
IC701
C700
IC700
D706
D801
D800
C800
C801
CNW202
SW713
up
SW712
auto
SW711
down
tuning
SW709
9
SW708
8
SW707
7
SW706
6
SW705
5
SW704
4
SW703
3
SW702
2
SW701
1
SW700
0
SW710
memory
SW802
LW
SW803
MW
SW804
FM
mono
SW805
FM
stereo
(muting)
SW800
hi-blend
SW801
air check

Figure 9 WIRING SIDE OF FRONT OPERATION CIRCUIT (KEYBOARD MATRIX), TUNING FREQUENCY DISPLAY / SIGNAL STRENGTH INDICATOR AND STATION FREQUENCY

AC supply cord	Bushing	Connection		Figure
		Ⓐ	Ⓑ	
QACCB0052AF09	LBSHC0002AGZZ	Brown	Blue	
QACCL0001AFZZ	LBSHC0007AFZZ	Brand stamp	Projection Stripe	
QACCV0001AGZZ	LBSHC0004AGZZ	Brown	Light blue	
QACCZ0002TA0F	LBSHC0007AFZZ	Brown	Brown	
QACCZ0053AF00	LBSHC0007AFZZ	Black	Black	

AC POWER SUPPLY CORD WIRING CONNECTIONS

AC SUPPLY VOLTAGE SELECTION

The unit operates on 110 V, 220 V, 240 V, AC supply of either 50 Hz or 60 Hz. Although the unit has been adjusted to a local supply voltage level, check the Voltage Selector setting.

1. Turn the Voltage Selector with the screw driver until the correct voltage reading appears adjacent to adjusting screw.

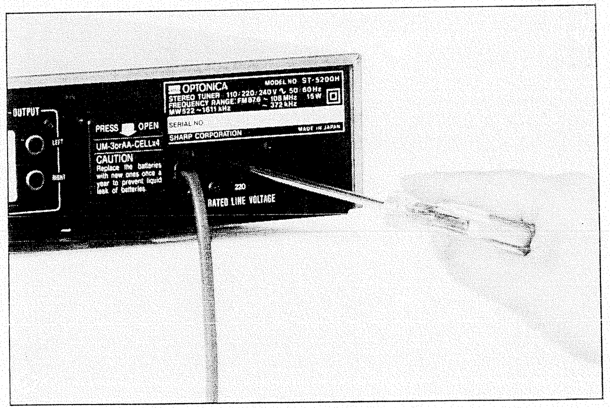

OUTPUT
LEFT
RIGHT
PRESS OPEN
UM-3orAA-CELLx4
CAUTION
Replace the batteries with new ones once a year to prevent liquid leak of batteries.
OPTONICA
MODEL NO ST-5200H
STEREO TUNER 110/220/240V ∿ 50/60Hz 15W
FREQUENCY RANGE: FM87.6 ~ 108 MHz
MW522 ~ 1611 kHz
~ 372 kHz
SERIAL NO
SHARP CORPORATION
MADE IN JAPAN
220
RATED LINE VOLTAGE

Figure 11

Note for users in UK

IMPORTANT:

The wires in the mains lead of this apparatus are coloured in accordance with the following code:

BLUE: "NEUTRAL"
BROWN: "LIVE"

CONNECTING PLUG TO MAINS LEAD:

As the colours of the wires in the mains lead of this apparatus may not correspond with the coloured marking identifying the terminals in your plug, proceed as follows:

- The wire which is coloured BLUE must be connected to the terminal which is marked with the letter N or coloured BLACK.
- The wire which is coloured BROWN must be connected to the terminal which is marked with the letter L or coloured RED.

This apparatus must be protected by a 3A fuse in the mains plug or distribution board.

This equipment leaves the factory adjusted for use on a 240 Volt (50 Hz) mains supply.

DISASSEMBLY

Prior to removing the chassis, be sure to draw the AC power supply plug from a wall outlet. Then, proceed with the removal work in the following order after disconnecting all of the connection cords at the rear of the set.

1) To remove the cabinet: (Refer to Figure 12–1)

1. Remove 4 screws ① retaining the cabinet (2 screws each for the right and left sides).
2. Shift the cabinet backward about 10 mm.
3. Giving a force to the bottom of cabinet, hold it up and remove.

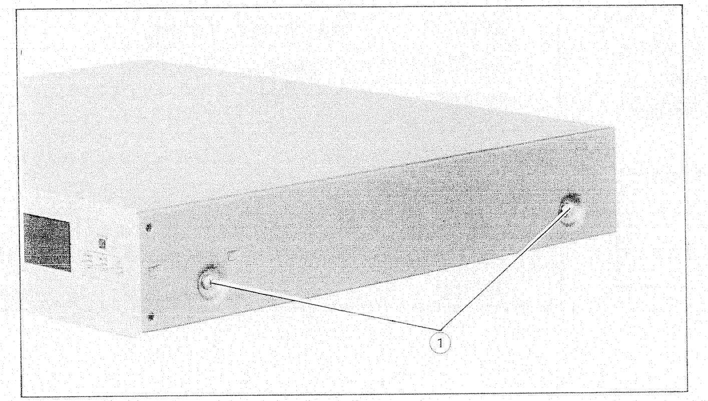


Figure 12–1

2) To remove the bottom board: (Refer to Figure 12–2)
Turn over the set and remove 10 screws ② retaining the bottom board, then the bottom board can be detached.

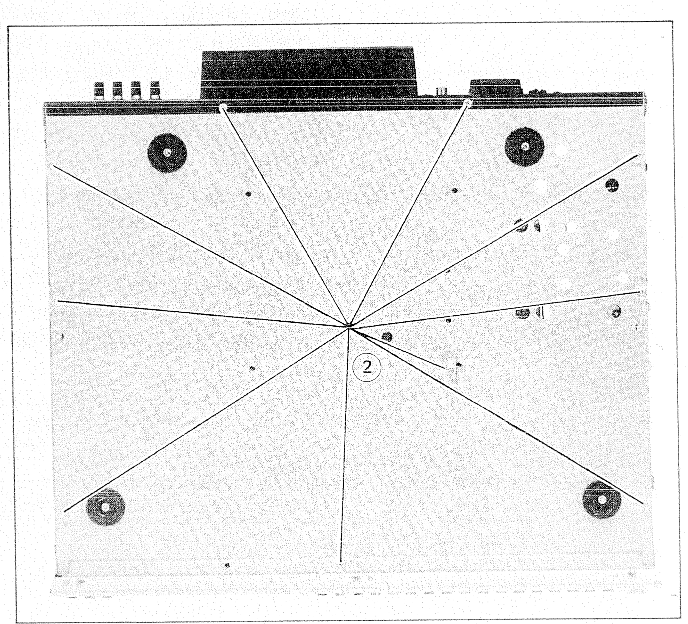


Figure 12–2

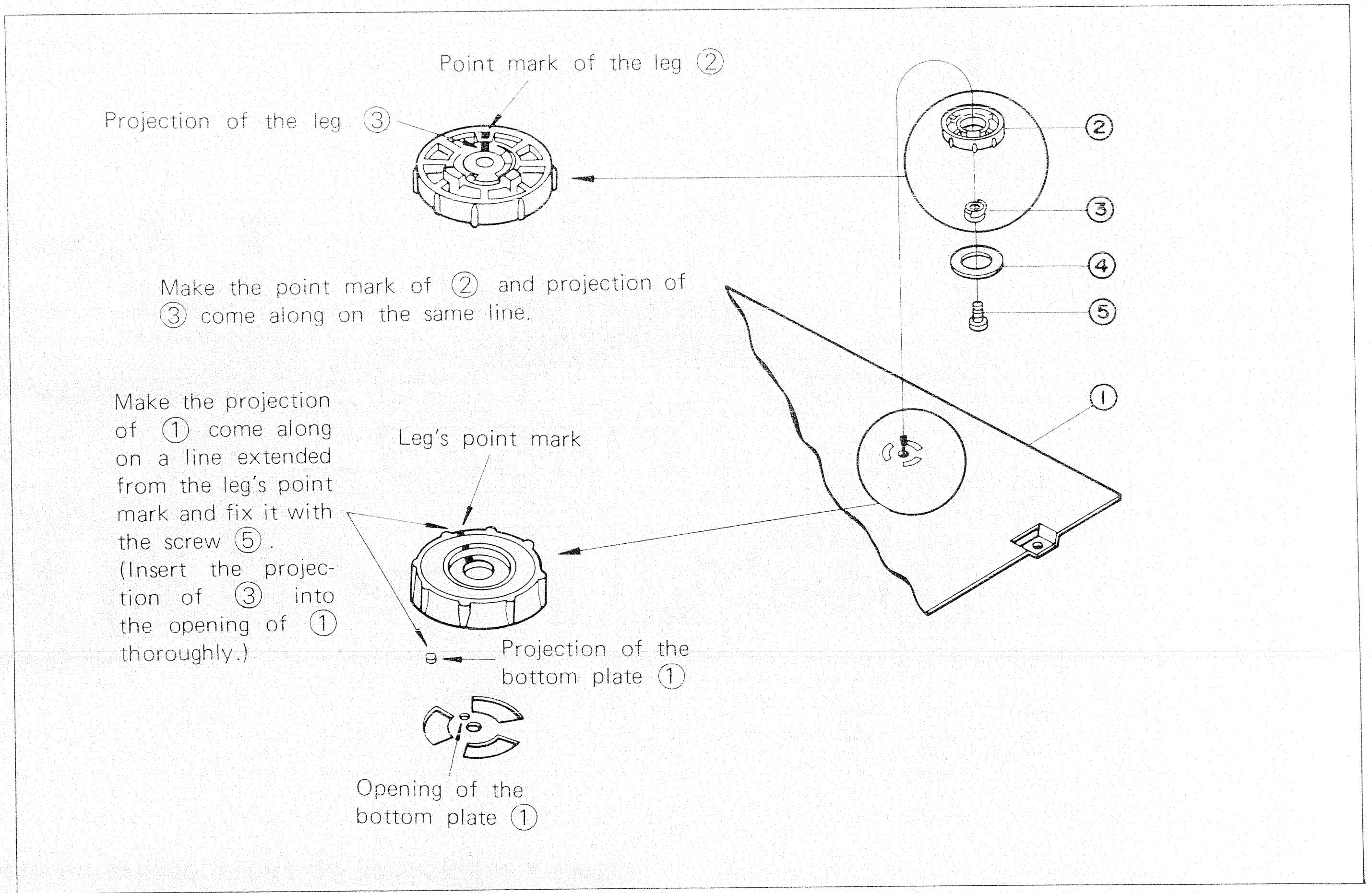

Point mark of the leg ②
Projection of the leg ③
②
③
④
⑤
Make the point mark of ② and projection of ③ come along on the same line.
①
Make the projection of ① come along on a line extended from the leg's point mark and fix it with the screw ⑤. (Insert the projection of ③ into the opening of ① thoroughly.)
Leg's point mark
Projection of the bottom plate ①
Opening of the bottom plate ①

Figure 12–3

REPLACEMENT PARTS LIST

"HOW TO ORDER REPLACEMENT PARTS"

To have your order filled promptly and correctly, please furnish the following information.

1. MODEL NUMBER
2. REF. NO.
3. PART NO.
4. DESCRIPTION

NOTES:
Be sure to use regular parts for securing the safety and reliability of the set. Parts marked with " △ " and parts crosshatched (in black) are especially important for maintaining the safety and protecting ability of the set.
Be sure to replace them with parts of specified part number.

INTEGRATED CIRCUITS

REF. NO.	PART NO.	DESCRIPTION	CODE
IC100	VHIHA11225/-1	FM. IF. Amplifier and Detector (HA11225)	AN
IC101	VHIHA12016/-1	P.L.L. Multiplex Stereo Demodulator (HA12016)	AL
IC200	VHILA1240//-1	AM. RF. Amplifier, Converter, IF Amplifier and Detector (LA1240)	AK
IC300	VHILM324///-1	Operational Amplifier (LM324)	AK
IC400	RH-IX1206AFZZ	TTL, Dual J-K Flip-Flop (HD7473P or SN7473N or M53273P)	AG
IC401	RH-IX1206AFZZ	TTL, Dual J-K Flip-Flop (HD7473P or SN7473N or M53273P)	AG
IC500	VHITD6102P/-1	ECL (Emitter Coupled Logic) Prescaler (TD6102P)	AT
IC501	VHITC9125BP-1	C-MOS, P.L.L. Synthesizer (TC9125BP)	AV
IC502	RH-IX1205AFZZ	C-MOS, FM, MW, LW, Frequency Synthesizer Controler (TC9129P)	BA
IC503	VHISN16889P-1	Signal LED Driver (SN16889P)	AK
IC700	VHITD62301P-1	C-MOS, 7 Segment-Inverting Buffer (TD62301P)	AK
IC701	VHITC5066BP-1	C-MOS, 7-High Voltage Buffer/Non Inverting Type (TC5066BP)	AP
IC702	VHITC5069BP-1	C-MOS, BCD to 7-Segment Latch, Decoder, Driver (TC5069BP)	AT

TRANSISTORS

REF. NO.	PART NO.	DESCRIPTION	CODE
Q100	VS3SK73-GR/-1	FM RF Circuit, FET (3SK73GR)	AF
Q101	VS2SC535-C/-1	FM Mixer Circuit (2SC535 Ⓒ)	AC
Q102	VS2SC461-B/-1	FM Oscillation Circuit (2SC461 Ⓑ)	AC
Q103	VS2SC460-B/-1	FM IF Amplifier Circuit (2SC460 Ⓑ)	AC
Q104	VS2SK61-Y//-1	FM Oscillation Circuit, FET (2SK61 Ⓨ)	AE
Q105	VS2SC945AP/-1	FM Circuit (2SC945AP)	AB
Q106	VS2SC945AP/-1	FM Muting Circuit (2SC945AP)	AB
Q107	VS2SC945AP/-1	FM Muting Circuit (2SC945AP)	AB
Q200	VS2SA999-F/-1	AM RF Circuit (2SA999 Ⓕ)	AC
Q201	VS2SA999-F/-1	AM RF Circuit (2SA999 Ⓕ)	AC
Q202	VS2SC380-Y/-1	AM RF Circuit (2SC380 Ⓨ)	AC
Q203	VS2SC380-Y/-1	AM RF Circuit (2SC380 Ⓨ)	AC
Q300	VS2SC945AP/-1	FM Muting Circuit (2SC945AP)	AB
Q301	VS2SC945AP/-1	FM Muting Circuit (2SC945AP)	AB
Q302	VS2SC2320-F-1	Audio Muting Circuit (2SC2320 Ⓕ)	AB
Q303	VS2SC2320-F-1	Audio Muting Circuit (2SC2320 Ⓕ)	AB
Q304	VS2SK106///1F	Hi-Blend SW Circuit (2SK106)	AE
Q305	VS2SA999-F/-1	Audio Muting Circuit (2SA999 Ⓕ)	AC
Q306	VS2SC945AP/-1	FM/AM Switching Circuit (2SC945AP)	AB
Q400	VS2SC945AP/-1	Flip-Flop Circuit (2SC945AP)	AB
Q401	VS2SC945AP/-1	Switching, Flip-Flop Circuit (2SC945AP)	AB
Q402	VS2SC945AP/-1	Switching, Flip-Flop Circuit (2SC945AP)	AB
Q403	VS2SC945AP/-1	Switching, Flip-Flop Circuit (2SC945AP)	AB
Q404	VS2SC945AP/-1	Switching, Flip-Flop Circuit (2SC945AP)	AB
Q405	VS2SC945AP/-1	Switching, Flip-Flop Circuit (2SC945AP)	AB
Q406	VS2SC945AP/-1	Switching, Flip-Flop Circuit (2SC945AP)	AB
Q407	VS2SC945AP/-1	Switching, Flip-Flop Circuit (2SC945AP)	AB
Q408	VS2SC945AP/-1	Switching, Flip-Flop Circuit (2SC945AP)	AB
Q500	VS2SC945AP/-1	Signal LED Driver (2SC945AP)	AB
Q501	VS2SC945AP/-1	Switching, FM/AM Selector (2SC945AP)	AB
Q502	VS2SK30A-Y/-1	Low-Pass Filter (2SK30A Ⓨ)	AD
Q503	VS2SC2320-F-1	Low-Pass Filter (2SC2320 Ⓕ)	AB
Q504	VS2SA999-F/-1	Signal LED Driver (2SA999 Ⓕ)	AC
Q505	VS2SA999-F/-1	Signal LED Driver (2SA999 Ⓕ)	AC
Q506	VS2SC945AP/-1	Signal LED Driver (2SC945AP)	AB
Q507	VS2SC945AP/-1	Synthesizer Controler Circuit (2SC945AP)	AB
△Q600	VS2SC2320-F-1	Power Supply Circuit (2SC2320 Ⓕ)	AB
△Q601	VS2SC2320-F-1	Power Supply Circuit (2SC2320 Ⓕ)	AB
△Q602	VS2SD313-K/-1	Power Supply Circuit (2SD313 Ⓚ)	AE
Q603	VS2SA999-F/-1	Power Supply Circuit (2SA999 Ⓕ)	AC
△Q604	VS2SC945AP/-1	Power Supply Circuit (2SC945AP)	AB
△Q605	VS2SD313-K/-1	Power Supply Circuit (2SD313 Ⓚ)	AE
Q606	VS2SC945AP/-1	Audio Muting Circuit (2SC945AP)	AB

PARTS LIST

REF. NO.	PART NO.	DESCRIPTION	CODE
Q607	VS2SC945AP/-1	Audio Muting Circuit (2SC945AP)	AB
Q608	VS2SC945AP/-1	Power Supply Circuit (2SC945AP)	AB
Q609	VS2SA999-F/-1	Power Supply Circuit (2SA999 Ⓕ)	AC
Q700	VS2SC945AP/-1	LED Indicator Circuit (2SC945AP)	AB
Q701	VS2SC945AP/-1	LED Indicator Circuit (2SC945AP)	AB
Q702	VS2SC945AP/-1	LED Indicator Circuit (2SC945AP)	AB
Q703	VS2SC945AP/-1	LED Indicator Circuit (2SC945AP)	AB
Q800	VS2SC945AP/-1	LED Indicator Circuit (2SC945AP)	AB
Q801	VS2SC945AP/-1	LED Indicator Circuit (2SC945AP)	AB
Q802	VS2SC945AP/-1	LED Indicator Circuit (2SC945AP)	AB
Q803	VS2SC945AP/-1	LED Indicator Circuit (2SC945AP)	AB
Q804	VS2SC945AP/-1	LED Indicator Circuit (2SC945AP)	AB
Q805	VS2SC945AP/-1	LED Indicator Circuit (2SC945AP)	AB
Q806	VS2SC945AP/-1	LED Indicator Circuit (2SC945AP)	AB
Q807	VS2SC945AP/-1	LED Indicator Circuit (2SC945AP)	AB
Q900	VS2SC732-G/-1	LW LED Controler Circuit (2SC732 Ⓖ)	AC

DIODES

REF. NO.	PART NO.	DESCRIPTION	CODE
D100	VHDBA243///-1	Switching, FM RF (BA243)	AC
D103	VHCSVC211//3F	Variable Capacity, FM Antenna (SVC211)	AD
D104	VHCSVC211//3F	Variable Capacity, FM RF (SVC211)	AD
D105	VHCSVC211//3F	Variable Capacity, FM RF (SVC211)	AD
D106	VHCSVC211//3F	Variable Capacity, FM Oscillation (SVC211)	AD
D107	VHD1S2076//-1	Switching, FM. OSC. Stop (1S2076)	AB
D108	VHD1S2076//-1	Switching, FM Operation Killer (1S2076)	AB
D109	VHD1S2076//-1	Switching, FM (1S2076)	AB
D200, D201, D202	VHCKV1225//3F	Variable Capacity, AM (KV1225)	AS
D203	VHDBA243///-1	Switching, AM Antenna Circuit (BA243)	AC
D204	VHDBA243///-1	Switching, AM Antenna Circuit (BA243)	AC
D205	VHDITT543//-1	Switching, AM Antenna Circuit (ITT543)	AB
D206	VHDITT543//-1	Switching, AM Antenna Circuit (ITT543)	AB
D207	VHDITT543//-1	Switching, AM Antenna Circuit (ITT543)	AB
D208	VHDITT543//-1	Switching, AM Antenna Circuit (ITT543)	AB
D209	VHDBA244///-1	Switching, AM Antenna Circuit (ITT543)	AC
D210	VHDBA244///-1	Switching, AM Antenna Circuit (ITT543)	AC
D211	VHDBA243///-1	Switching, AM Antenna Circuit (BA243)	AC
D212	VHDBA243///-1	Switching, AM Antenna Circuit (BA243)	AC
D213	VHD1S2076//-1	Switching, AM Oscillation Stop (1S2076)	AB
D214	VHD1N60////-1	Rectifier, AM Auto Stop Signal (1N60)	AB
D215	VHD1N60////-1	Rectifier, AM Auto Stop Signal (1N60)	AB
D300	VHD1S2076//-1	Switching, Limiter Air Check Oscillation Circuit (1S2076)	AB
D301	VHD1S2076//-1	Switching, Limiter Air Check Oscillation Circuit (1S2076)	AB
D302	VHD1S2076//-1	Switching, VCO Stop (1S2076)	AB
D303	VHD1S2076//-1	Switching, FM Mono (1S2076)	AB
D304	VHD1S2076//-1	Switching, High Blend Circuit (1S2076)	AB
D305	VHD1S2076//-1	Switching, High Blend Circuit (1S2076)	AB
D306	VHD1S2076//-1	Switching, Air Check Circuit (1S2076)	AB
D307	VHD1S2076//-1	Switching, Air Check Circuit (1S2076)	AB
D308	VHD1S2076//-1	Siwtching, Operational Amplifier Circuit (1S2076)	AB
D500	VHD1S2076//-1	Switching, Synthesizer Controler Circuit (1S2076)	AB
D501	VHD1S2076//-1	Switching, Synthesizer Controler Circuit (1S2076)	AB
D502	VHD1S2076//-1	Switching, Synthesizer Controler Circuit (1S2076)	AB
D503	VHD1S2076//-1	Switching, Signal LED Driver Circuit (1S2076)	AB
D504	VHD1S2076//-1	Switching, Signal LED Driver Circuit (1S2076)	AB
D505	VHD1S2076//-1	Switching, Signal LED Driver Circuit (1S2076)	AB
D506	VHD1S2076//-1	Switching, Signal LED Driver Circuit (1S2076)	AB
D507	VHD1S2076//-1	Switching, Muting Signal Controler Circuit (1S2076)	AB
△D600	VHD1S2076//-1	Rectifier, Power Supply Circuit (1S2076)	AB
D601	VHD1S2076//-1	Rectifier, Power Supply Circuit (1S2076)	AB
△D602	VHD10E1////-1	Rectifier, Power Supply Circuit (10E1)	AC
△D603	VHD10E1////-1	Rectifier, Power Supply Circuit (10E1)	AC
△D604	VHD10E1////-1	Rectifier, Power Supply Circuit (10E1)	AC
△D605	VHD10E1////-1	Rectifier, Power Supply Circuit (10E1)	AC
△D606	VHD1S2076//-1	Rectifier, Power Supply Circuit (1S2076)	AB
△D607	VHD1S2076//-1	Rectifier, Power Supply Circuit (1S2076)	AB
△D608	VHD1S2076//-1	Rectifier, Power Supply Circuit (1S2076)	AB

PARTS LIST

REF. NO.	PART NO.	DESCRIPTION	CODE
△D609	VHD10E1////-1	Rectifier, Power Supply Circuit (10E1)	AC
D610	VHD1S2076//-1	Rectifier, Power Supply Circuit (1S2076)	AB
D612	VHD1N60////-1	Switching, Audio Muting Circuit (1N60)	AB
D613	VHD1N60////-1	Switching, Audio Muting Circuit (1N60)	AB
D614	VHD1S2076//-1	Rectifier, Power Supply Circuit (1S2076)	AB
D615	VHD1S2076//-1	Rectifier, Power Supply Circuit (1S2076)	AB
D616	VHD1S2076//-1	Switching, Audio Muting Circuit (1S2076)	AB
D617	VHD1S2076//-1	Rectifier, Power Supply Circuit (1S2076)	AB
D700	VHD1S2076//-1	Switching, Key Matrix (1S2076)	AB
D701	VHD1S2076//-1	Switching, Key Matrix (1S2076)	AB
D702	VHD1S2076//-1	Switching, Key Matrix (1S2076)	AB
D703	VHD1S2076//-1	Switching, Key Matrix (1S2076)	AB
D704	VHD1S2076//-1	Switching, Frequency Disply (1S2076)	AB
D705	VHD1S2076//-1	Switching, Frequency Disply (1S2076)	AB
D706	VHD1S2076//-1	Switching, Key Matrix (1S2076)	AB
D800	VHD1S2076//-1	Switching, Key Matrix (1S2076)	AB
D801	VHD1S2076//-1	Switching, Key Matrix (1S2076)	AB
D900	VHD1S1555V/1G	Switching, LW LED Controler Circuit (1S1555V)	AB
D901	VHD1S1555V/1G	Switching, LW LED Controler Circuit (1S1555V)	AB
D902	VHD1S1555V/1G	Switching, LW LED Controler Circuit (1S1555V)	AB
D903	VHD1S1555V/1G	Switching, LW LED Controler Circuit (1S1555V)	AB
D904	VHD1S1555V/1G	Switching, LW LED Controler Circuit (1S1555V)	AB
D905	VHD1S1555V/1G	Switching, LW LED Controler Circuit (1S1555V)	AB
D906	VHD1S1555V/1G	Switching, LW LED Controler Circuit (1S1555V)	AB
D907	VHD1S1555V/1G	Switching, LW LED Controler Circuit (1S1555V)	AB

ZENER DIODES

REF. NO.	PART NO.	DESCRIPTION	CODE
ZD300	VHERD5R1JB2-1	Voltage Regulator, 4.97 ~5.23V (RD5R1J . B2)	AB
ZD301	VHERD5R6JB2-1	Voltage Regulator, 5.48 ~5.76V (RD5R6J . B2)	AB
△ZD600	VHERD5R6JB2-1	Voltage Regulator, Power Supply Circuit, 5.48 ~5.76V (RD5R6J . B2)	AB
△ZD601	VHERD270JB3-1	Voltage Regulator, Power Supply Circuit, 27.21 ~28.61V (RD270J . B3)	AB
△ZD602	VHERD5R6JB2-1	Voltage Regulator, Power Supply Circuit, 5.48 ~5.76V (RD5R6J . B2)	AB
△ZD603	VHERD5R6JB2-1	Voltage Regulator, Power Supply Circuit, 5.48 ~5.76V (RD5R6J . B2)	AB

LED's

(Light Emitting Diode)

REF. NO.	PART NO.	DESCRIPTION	CODE
LED700	VHPGL-9NG12-1	8 Input/Pre-Setting Indicator (GL-9NG12)	AD
LED701	VHPGL-9NG12-1	7 Input/Pre-Setting Indicator (GL-9NG12)	AD
LED702	VHPGL-9NG12-1	6 Input/Pre-Setting Indicator (GL-9NG12)	AD
LED703	VHPGL-9NG12-1	5 Input/Pre-Setting Indicator (GL-9NG12)	AD
LED704	VHPGL-9NG12-1	4 Input/Pre-Setting Indicator (GL-9NG12)	AD
LED705	VHPGL-9NG12-1	3 Input/Pre-Setting Indicator (GL-9NG12)	AD
LED706	VHPGL-9NG12-1	2 Input/Pre-Setting Indicator (GL-9NG12)	AD
LED707	VHPGL-9NG12-1	1 Input/Pre-Setting Indicator (GL-9NG12)	AD
LED708	VHPGL-9NG12-1	0 Input/Pre-Setting Indicator (GL-9NG12)	AD
LED709	VHPGL-9NG12-1	Pre-Set Station Memory Indicator (GL-9NG12)	AD
LED710	VHPGL-9NG12-1	9 Input/Pre-Setting Indicator (GL-9NG12)	AD
LED711	VHPGL-9PR4X-1	Automatic Tuning Indicator (GL-9PR4)	AC
LED800	VHPGL-9NG12-1	High Blend Indicator (GL-9NG12)	AD
LED801	VHPGL-9NG12-1	FM Air Check Indicator (GL-9NG12)	AD
LED802	VHPGL-9NG12-1	FM Stereo Indicator (GL-9NG12)	AD
LED803	VHPGL-9NG12-1	FM Mono Indicator (GL-9NG12)	AD
LED804	VHPGL-9NG12-1	MW Indicator (GL-9NG12)	AD
LED805	VHPGL-9NG12-1	LW Indicator (GL-9NG12)	AD
LA700	VHPSEL8820A1F	LED Array, Signal Strengh Indicator and FM Stereo Broadcast Indicator (SEL8820A)	AP

COILS

REF. NO.	PART NO.	DESCRIPTION	CODE
L100	RCILA0475AFZZ	FM Balun, 300 – 75 ohm	AD
L101	RCILA0478AFZZ	FM – Antenna	AD
L102	RCILR0346AFZZ	FM – RF	AD
L103	RCILR0347AFZZ	FM – RF	AD
L104	RCILB0490AFZZ	FM – Oscillation	AD
L105	RCILC0079AFZZ	FM – RF Choke	AC
L106	VP-CH220K0000	22 µH Choke +B	AB
L200	RCILB0487AFZZ	LW – Oscillation	AD
L201	RCILB0489AFZZ	MW – Oscillation	AD
L205	VP-LK222K0000	2.2 mH Choke	AC
L206	VP-CH681K0000	680 µH IF	AB
L400	VP-LK101M0000	100 µH Choke	AB
L500	VP-CF101K0000	100 µH Choke +B	AB
L501	VP-CF101K0000	100 µH Choke +B	AB
L502	RCILI0286AFZZ	Oscillation (Microprocessor)	AD
L503	VP-CF101K0000	100 µH Choke +B	AB
LA200	RCILA0477AFZZ	MW/LW Ferrite Bar Antenna	AM

PARTS LIST

FILTERS

REF. NO.	PART NO.	DESCRIPTION	CODE
CF100	RFILF0072AFZZ	10,700MHz ±20kHz (Red), FM IF, Ceramic	AG
CF101	RFILF0073AFZZ	10,700MHz ±20kHz (Red), FM IF, Ceramic	AG
CF200	RFILA0062AFZZ	450kHz, AM IF, Ceramic	AG
CF201	RFILA0080AFZZ	450kHz (A-SP), AM IF, Ceramic	AF
FL300	RFILL0060AFZZ	Low-Pass Filter, 19 – 38kHz	AH
FL301	RFILL0060AFZZ	Low-Pass Filter, 19 – 38kHz	AH

TRANSFORMERS

REF. NO.	PART NO.	DESCRIPTION	CODE
T100	RCILI0237AFZZ	FM IF	AD
T101	RCILD0072AFZZ	Quadrature (10.7MHz), FM Demodulator	AE
T102	RCILD0071AFZZ	Quadrature (10.7MHz), FM Demodulator	AE
T200	RCILI0281AFZZ	AM IF (450kHz)	AD
T201	RCILI0280AFZZ	AM IF (A-SP, 450kHz)	AD
△T601	RTRNP0704AFZZ	Power	AV

TRIMMER CAPACITORS

REF. NO.	PART NO.	DESCRIPTION	CODE
TC100	RTO-H1030AGZZ	FM – Antenna	AC
TC101	RTO-H1030AGZZ	FM – RF	AC
TC102	RTO-H1030AGZZ	FM – RF	AC
TC103	RTO-H1030AGZZ	FM – Oscillation	AC
TC200, TC201	RTO-H2051AFZZ	MW/LW – Antenna	AE
TC202	RTO-H1053AFZZ	MW – Oscillation	AC
TC203	RTO-H1053AFZZ	LW – Oscillation	AC

CONTROLS

REF. NO.	PART NO.	DESCRIPTION	CODE
VR101	RVR-M0156AFZZ	20K ohm (B), FM Muting Width Adjust	AC
VR200	RVR-M0263AFZZ	20K ohm (B), FM Muting Level Adjust	AC
VR300	RVR-M0261AFZZ	15K ohm (B), V.C.O. Frequency Adjust	AC
VR301	RVR-M0266AFZZ	200K ohm (B), Stereo Separation Adjust	AC
VR302	RVR-M0265AFZZ	100K ohm (B), Air Check Level Adjust	AC

CRYSTAL

REF. NO.	PART NO.	DESCRIPTION	CODE
XL500	RCRSB0069AFZZ	9.00MHz, P.L.L.	AK

ELECTROLYTIC CAPACITORS

REF. NO.	PART NO.	DESCRIPTION	CODE
C100	RC-EZA105AF1H	1MFD, 50V, ±20%	AB
C104	RC-EZA106AF1C	10MFD, 16V, ±20%	AB
C125	RC-EZA105AF1H	1MFD, 50V, ±20%	AB
C137	RC-EZV337AF1C	330MFD, 16V, ±20%	AC
C139	VCEALA1HW474M	.47MFD, 50V, ±20%	AB
C142	RC-EZV106AF1H	10MFD, 50V, ±20%	AB
C144	RC-EZA335AF1H	3.3MFD, 50V, ±20%	AB
C145	RC-EZA106AF1C	10MFD, 16V, ±20%	AB
C146	RC-EZV107AF1C	100MFD, 16V, ±20%	AB
C148	RC-EZA106AF1C	10MFD, 16V, ±20%	AB
C217	RC-EZA106AF1C	10MFD, 16V, ±20%	AB
C226	RC-EZA475AF1H	4.7MFD, 50V, ±20%	AB
C227	RC-EZA335AF1H	3.3MFD, 50V, ±20%	AB
C229	VCEALV1HW104K	.1MFD, 50V, ±10%	AC
C230	RC-EZA105AF1H	1MFD, 50V, ±20%	AB
C241	RC-EZA106AF1C	10MFD, 16V, ±20%	AB
C301	RC-EZA106AF1C	10MFD, 16V, ±20%	AB
C303	RC-EZV476AF1E	47MFD, 25V, ±20%	AB
C305	RC-EZA106AF1C	10MFD, 16V, ±20%	AB
C306	RC-EZA335AF1H	3.3MFD, 50V, ±20%	AB
C307	RC-EZA105AF1H	1MFD, 50V, ±20%	AB
C309	RC-EZA335AF1H	3.3MFD, 50V, ±20%	AB
C311	RC-EZA335AF1H	3.3MFD, 50V, ±20%	AB
C312	RC-EZA105AF1H	1MFD, 50V, ±20%	AB
C313	RC-EZA336AF1C	33MFD, 16V, ±20%	AB
C315	RC-EZA106AF1C	10MFD, 16V, ±20%	AB
C316	RC-EZA106AF1C	10MFD, 16V, ±20%	AB
C318	RC-EZA336AF1C	33MFD, 16V, ±20%	AB
C319	RC-EZV477AF1C	470MFD, 16V, ±20%	AC
C324	RC-EZA105AF1H	1MFD, 50V, ±20%	AB
C325	RC-EZA106AF1C	10MFD, 16V, ±20%	AB
C326	RC-EZA475AF1H	4.7MFD, 50V, ±20%	AB
C327	RC-EZA106AF1C	10MFD, 16V, ±20%	AB
C328	RC-EZA105AF1H	1MFD, 50V, ±20%	AB
C404	RC-EZA106AF1C	10MFD, 16V, ±20%	AB
C406	RC-EZA475AF1H	4.7MFD, 50V, ±20%	AB
C407	RC-EZA475AF1H	4.7MFD, 50V, ±20%	AB
C500	RC-EZA107AF1C	100MFD, 16V, ±20%	AB
C503	RC-EZS477AF1C	470MFD, 16V, +30% –10%	AC
C505	RC-EZA475AF1H	4.7MFD, 50V, ±20%	AB
C507	RC-EZV477AF1C	470MFD, 16V, ±20%	AC
C509	RC-EZA475AF1H	4.7MFD, 50V, ±20%	AB
C512	RC-EZA476AF1A	47MFD, 10V, ±20%	AB
C513	RC-EZ1134AFZZ	2.2MFD, 50V, ±20%, Non-Polar	AC
C515	RC-EZA475AF1H	4.7MFD, 50V, ±20%	AB
C528	RC-EZA476AF1H	47MFD, 50V, ±20%	AC
C529	RC-EZA105AF1H	1MFD, 50V, ±20%	AB
△C600	RC-EZV107AF1H	100MFD, 50V, ±20%	AB
C604	RC-EZV107AF1H	100MFD, 50V, ±20%	AB
C606	RC-EZW228AF1V	2200MFD, 35V, ±20%	AC
C607	RC-EZV227AF1J	220MFD, 63V, ±20%	AC
C608	RC-EZV107AF1H	100MFD, 50V, ±20%	AB
C609	RC-EZV107AF1H	100MFD, 50V, ±20%	AB
C611	RC-EZA476AF1H	47MFD, 50V, ±20%	AC
△C614	RC-EZV227AF1A	220MFD, 10V, ±20%	AC
C616	RC-EZV476AF1E	47MFD, 25V, ±20%	AB
C617	RC-EZA106AF1C	10MFD, 16V, ±20%	AB
C619	RC-EZA336AF1C	33MFD, 16V, ±20%	AB
C620	RC-EZA105AF1H	1MFD, 50V, ±20%	AB
C621	RC-EZA106AF1C	10MFD, 16V, ±20%	AB
C622	RC-EZV227AF1V	220MFD, 35V, ±20%	AD
C623	VCEALA1HW334M	.33MFD, 50V, ±20%	AB
C624	RC-EZA475AF1H	4.7MFD, 50V, ±20%	AB
C625	VCEAAU1HW105Y	1MFD, 50V, +50 –10%	AB
C626	VCEAAU1CW106Y	10MFD, 16V, +50 –10%	AB
C703	VCEAAU1CW106Y	10MFD, 16V, +50 –10%	AB
C705	VCEAAU1CW106Y	10MFD, 16V, +50 –10%	AB
C800	VCEAAU1HW105Y	1MFD, 50V, +50 –10%	AB
C801	VCEAAU1HW105Y	1MFD, 50V, +50 –10%	AB

PARTS LIST

CAPACITORS

REF. NO.	PART NO.	DESCRIPTION	CODE
C101	VCTYPA1EX473M	.047MFD, 25V, ±20%, Semiconductor	AB
C102	VCTYPA1EX473M	.047MFD, 25V, ±20%, Semiconductor	AB
C103	VCTYPA1EX103M	.01MFD, 25V, ±20%, Semiconductor	AA
C105	VCTYPA1EX473M	.047MFD, 25V, ±20%, Semiconductor	AB
C106	VCCTPV1HH4R0D	4PF, 50V, ±0.5%, Ceramic	AA
C107	VCCSPA1HL271J	270PF, 50V, ±5%, Ceramic	AA
C108	VCKZPA1HF223Z	.022MFD, 50V, +80% −20%, Ceramic	AA
C109	VCTYPA1EX222K	.0022MFD, 25V, ±10%, Semiconductor	AA
C110	VCTYPA1EX222K	.0022MFD, 25V, ±10%, Semiconductor	AA
C111	VCTYPA1EX473M	.047MFD, 25V, ±20%, Semiconductor	AB
C112	VCKZPA1HF223Z	.022MFD, 50V, +80% −20%, Ceramic	AA
C113	VCCTPV1HH5R0D	5PF, 50V, ±0.5%, Ceramic	AA
C114	VCCTPV1HH5R0D	5PF, 50V, ±0.5%, Ceramic	AA
C115	VCCTPV1HH8R0D	8PF, 50V, ±0.5%, Ceramic	AA
C116	VCCSPA1HL101J	100PF, 50V, ±5%, Ceramic	AA
C117	VCTYPA1EX103M	.01MFD, 25V, ±20%, Semiconductor	AA
C118	VCCCPV1HH1R0C	1PF, 50V, ±0.25%, Ceramic	AA
C119	VCCTPV1HH7R0D	7PF, 50V, ±0.5%, Ceramic	AA
C121	VCCTPV1HH7R0D	7PF, 50V, ±0.5%, Ceramic	AA
C122	VCCCPV1HH1R5C	1.5PF, 50V, ±0.25%, Ceramic	AA
C124	VCKZPA1HF223Z	.022MFD, 50V, +80% −20%, Ceramic	AA
C126	VCKZPA1HF223Z	.022MFD, 50V, +80% −20%, Ceramic	AA
C127	VCKZPA1HF223Z	.022MFD, 50V, +80% −20%, Ceramic	AA
C128	VCKZPA1HF223Z	.022MFD, 50V, +80% −20%, Ceramic	AA
C129	VCKZPA1HF223Z	.022MFD, 50V, +80% −20%, Ceramic	AA
C130	VCTYPA1EX103M	.01MFD, 25V, ±20%, Semiconductor	AA
C131	VCTYAT1CY223N	.022MFD, 16V, ±30%, Semiconductor	AA
C132	VCCSAT1HL220J	22PF, 50V, ±5%, Ceramic	AA
C133	VCTYPA1EX102M	.002MFD, 25V, ±20%, Semiconductor	AA
C134	VCKZPU1HF403Z	.04MFD, 50V, +80% −20%, Ceramic	AA
C135	VCTYPA1EX473M	.047MFD, 25V, ±20%, Semiconductor	AB
C136	VCTYPA1EX473M	.047MFD, 25V, ±20%, Semiconductor	AB
C138	VCTYPA1EX473M	.047MFD, 25V, ±20%, Semiconductor	AB
C140	VCTYPA1EX473M	.047MFD, 25V, ±20%, Semiconductor	AB
C141	VCCSPA1HL331J	330PF, 50V, ±5%, Ceramic	AA
C143	VCTYPA1EX473M	.047MFD, 25V, ±20%, Semiconductor	AB
C147	VCCSPV1HL5R0D	5PF, 50V, ±0.5%, Ceramic	AA
C149	VCKZPA1HF223Z	.022MFD, 50V, +80% −20%, Ceramic	AA
C200	VCKZPA1HF223Z	.022MFD, 50V, +80% −20%, Ceramic	AA
C201	VCTYAT1CY223N	.022MFD, 16V, ±30%, Semiconductor	AA
C202	VCKZPA1HF223Z	.022MFD, 50V, +80% −20%, Ceramic	AA
C203	VCCXPV1HL120J	12PF, 50V, ±5%, Ceramic	
C204	VCCXPV1HL7R0D	7PF, 50V, ±0.5%, Ceramic	
C205	VCKZPA1HF223Z	.022MFD, 50V, +80% −20%, Ceramic	AA
C206	VCKZPA1HF223Z	.022MFD, 50V, +80% −20%, Ceramic	AA
C207	VCTYPA1EX473M	.047MFD, 25V, ±20%, Semiconductor	AB
C210	VCCXPV1HL100C	10PF, 50V, ±0.25%, Ceramic	AB
C211	VCQSMA1HL391J	390PF, 50V, ±5%, Styrol	AB
C212	VCQSMA1HL471J	470PF, 50V, ±5%, Styrol	AB
C213	VCCSPV1HH680J	68PF, 50V, ±5%, Ceramic	
C214	VCKZPA1HF223Z	.022MFD, 50V, +80% −20%, Ceramic	AA
C215	VCTYPA1EX473M	.047MFD, 25V, ±20%, Semiconductor	AA
C216	VCTYPA1EX473M	.047MFD, 25V, ±20%, Semiconductor	AA
C218	VCCSAT1HL560J	56PF, 50V, ±5%, Ceramic	AA
C219	VCTYAT1CY223N	.022MFD, 16V, ±30%, Semiconductor	AA
C220	VCTYAT1CY223N	.022MFD, 16V, ±30%, Semiconductor	AA
C221	VCKYAT1HB102K	.001MFD, 50V, ±10%, Ceramic	AA
C222	VCTYPA1EX473M	.047MFD, 25V, ±20%, Semiconductor	AA
C223	VCCSPU1HL181J	180PF, 50V, ±5%, Ceramic	AA
C224	VCQYKU1HM223K	.022MFD, 50V, ±10%, Mylar	AB
C225	VCKYAT1HB821K	820PF, 50V, ±10%, Ceramic	AA
C228	VCKYAT1HB102K	.001MFD, 50V, ±10%, Ceramic	AA
C231	VCTYPA1EX473M	.047MFD, 25V, ±20%, Semiconductor	AB
C232	VCKYAT1HB102K	.001MFD, 50V, ±10%, Ceramic	AA
C233	VCTYAT1EX103M	.01MFD, 25V, ±20%, Semiconductor	AA
C234	VCTYAT1EX103M	.01MFD, 25V, ±20%, Semiconductor	AA
C235	VCTYAT1CY223N	.022MFD, 16V, ±30%, Semiconductor	AA
C236	VCTYAT1EX103M	.01MFD, 25V, ±30%, Semiconductor	AB
C237	VCTYPA1EX473M	.047MFD, 25V, ±20%, Semiconductor	AA
C238	VCTYPA1EX473M	.047MFD, 25V, ±20%, Semiconductor	AB
C239	VCCSPV1HH8R0D	8PF, 50V, ±0.5%, Ceramic	
C240	VCKZPA1HF223Z	.022MFD, 50V, +80% −20%, Ceramic	AA
C302	VCQYKA1HM183J	.018MFD, 50V, ±5%, Mylar	AB
C304	VCQYKA1HM183J	.018MFD, 50V, ±5%, Mylar	AB
C308	VCQSMA1HL102J	.001MFD, 50V, ±5%, Styrol	AB
C310	VCQYKA1HM473J	.047MFD, 50V, ±5%, Mylar	AB
C314	VCQYKA1HM102J	.001MFD, 50V, ±5%, Mylar	AB
C317	VCQYKA1HM102J	.001MFD, 50V, ±5%, Mylar	AB
C320	VCQYKA1HM123J	.012MFD, 50V, ±5%, Mylar	AB
C321	VCCSAT1HL100J	10PF, 50V, ±5%, Ceramic	AA
C322	VCCSPA1HL121J	120PF, 50V, ±5%, Ceramic	AA
C323	VCQYKA1HM183J	.018MFD, 50V, ±5%, Mylar	AB

PARTS LIST

REF. NO.	PART NO.	DESCRIPTION	CODE
C329	VCTYAT1EX103M	.01MFD, 25V, ±20%, Semiconductor	AA
C400	VCTYPA1EX473M	.047MFD, 25V, ±20%, Semiconductor	AB
C402	VCTYPA1EX473M	.047MFD, 25V, ±20%, Semiconductor	AB
C408	VCTYPA1EX473M	.047MFD, 25V, ±20%, Semiconductor	AB
C409	VCTYPU1EX103M	.01MFD, 25V, ±20%, Semiconductor	AA
C410	VCTYPU1EX103M	.01MFD, 25V, ±20%, Semiconductor	AA
C501	VCTYPA1EX473M	.047MFD, 25V, ±20%, Semiconductor	AB
C504	VCKZPA1HF223Z	.022MFD, 50V, +80% –20%, Ceramic	AA
C506	VCCSPA1HL330J	33PF, 50V, ±5%, Ceramic	AA
C508	VCTYPA1EX473M	.047MFD, 25V, ±20%, Semiconductor	AB
C510	VCKYAT1HB221K	220PF, 50V, ±10%, Ceramic	AA
C511	VCKYAT1HB221K	220PF, 50V, ±10%, Ceramic	AA
C514	VCKZPA1HF223Z	.022MFD, 50V, +80% –20%, Ceramic	AA
C516	VCKZPA1HF223Z	.022MFD, 50V, +80% –20%, Ceramic	AA
C517	VCKZPA1HF223Z	.022MFD, 50V, +80% –20%, Ceramic	AA
C519	VCTYAT1EX103M	.01MFD, 25V, ±20%, Semiconductor	AA
C520	VCKZPA1HF223Z	.022MFD, 50V, +80% –20%, Ceramic	AA
C521	VCKZPA1HF223Z	.022MFD, 50V, +80% –20%, Ceramic	AA
C522	VCKZPU1HF104Z	.1MFD, 50V, +80% –20%, Ceramic	AB
C523	VCKZPU1HF104Z	.1MFD, 50V, +80% –20%, Ceramic	AB
C530	VCKZPU1HF403Z	.04MFD, 50V, +80% –20%, Ceramic	AA
C601	VCQYKU2AM333K	.033MFD, 100V, ±10%, Mylar	AB
C602	VCQYKU2AM333K	.033MFD, 100V, ±10%, Mylar	AB
C603	VCQYKU2AM333K	.033MFD, 100V, ±10%, Mylar	AB
C605	VCKZPA1HF223Z	.022MFD, 100V, +80% –20%, Ceramic	AA
C610	VCKZPA1HF223Z	.022MFD, 50V, +80% –20%, Ceramic	AA
C612	VCKZPA1HF223Z	.022MFD, 50V, +80% –20%, Ceramic	AA
C615	VCKZPA1HF223Z	.022MFD, 50V, +80% –20%, Ceramic	AA
C700	VCFYKU1HA474J	.47MFD, 50V, ±5%, Metallized Film	AD
C702	VCTYPA1EX473M	.047MFD, 25V, ±20%, Semiconductor	AB
C704	VCKZPU1HF403Z	.04MFD, 50V, +80% –20%, Ceramic	AA
C706	VCKZPU1HF403Z	.04MFD, 50V, +80% –20%, Ceramic	AA
C710	VCKZPU1HF403Z	.04MFD, 50V, +80% –20% Ceramic	AA
C900	VCQYKU1HM473K	.047MFD, 50V, ±10%, Mylar	AB

RESISTORS

(Unless otherwise specified resistors are 1/4W, ±5%, Carbon Type.)

REF. NO.	PART NO.	DESCRIPTION	CODE
R100	VRD-ST2EE222J	2.2K ohm	AA
R101	VRD-ST2EE222J	2.2K ohm	AA
R102	VRD-ST2EE154J	150K ohm	AA
R103	VRD-ST2EE104J	100K ohm	AA
R104	VRD-ST2EE105J	1M ohm	AA
R105	VRD-ST2EE104J	100K ohm	AA
R106	VRD-ST2EE101J	100 ohm	AA
R107	VRD-ST2EE470J	47 ohm	AA
R108	VRD-ST2EE330J	33 ohm	AA
R109	VRD-ST2EE104J	100K ohm	AA
R110	VRD-ST2EE681J	680 ohm	AA
R111	VRD-ST2EE104J	100K ohm	AA
R112	VRD-ST2EE103J	10K ohm	AA
R113	VRD-ST2EE472J	4.7K ohm	AA
R114	VRD-ST2EE104J	100K ohm	AA
R115	VRD-ST2EE102J	1K ohm	AA
R116	VRD-ST2EE223J	22K ohm	AA
R118	VRD-ST2EE103J	10K ohm	AA
R119	VRD-ST2EE103J	10K ohm	AA
R120	VRD-ST2EE332J	3.3K ohm	AA
R121	VRD-SU2EE272J	2.7K ohm	AA
R122	VRD-ST2EE330J	33 ohm	AA
⚠R123	VRD-ST2EE101J	100 ohm	AA
R124	VRD-ST2EE470J	47 ohm	AA
R125	VRD-ST2EE474J	470K ohm	AA
R126	VRD-ST2EE331J	330 ohm	AA
R127	VRD-ST2EE220J	22 ohm	AA
R128	VRD-ST2EE104J	100K ohm	AA
R129	VRD-ST2EE222J	2.2K ohm	AA
R130	VRD-ST2EE331J	330 ohm	AA
R131	VRD-ST2EE154J	150K ohm	AA
R132	VRD-ST2EE333J	33K ohm	AA
R133	VRD-ST2EE104J	100K ohm	AA
R134	VRD-ST2EE333J	33K ohm	AA
R135	VRD-ST2EE683J	68K ohm	AA
R136	VRD-ST2EE103J	10K ohm	AA
R137	VRD-ST2EE183J	18K ohm	AA
R138	VRD-ST2EE333J	33K ohm	AA
R139	VRD-ST2EE330J	33 ohm	AA
R140	VRD-ST2EE154J	150K ohm	AA
R141	VRD-ST2EE104J	100K ohm	AA
R142	VRD-SU2EE333J	33K ohm	AA
R143	VRD-ST2EE102J	1K ohm	AA
R144	VRD-ST2EE102J	1K ohm	AA
R145	VRD-ST2EE273J	27K ohm	AA
R146	VRD-ST2EE124J	120K ohm	AA
R147	VRD-SU2EE154J	150K ohm	AA
R148	VRD-SU2EE333J	33K ohm	AA
R149	VRD-SU2EE333J	33K ohm	AA
R150	VRD-SU2EE104J	100K ohm	AA
R152	VRD-SU2EE330J	33 ohm	AA
R153	VRD-SU2EE333J	33K ohm	AA
R202	VRD-ST2EE104J	100K ohm	AA
R203	VRD-ST2EE104J	100K ohm	AA
R204	VRD-ST2EE104J	100K ohm	AA
R206	VRD-ST2EE561J	560 ohm	AA
R207	VRD-ST2EE561J	560 ohm	AA
R208	VRD-ST2EE104J	100K ohm	AA

PARTS LIST

REF. NO.	PART NO.	DESCRIPTION	CODE	REF. NO.	PART NO.	DESCRIPTION	CODE
R209	VRD-ST2EE561J	560 ohm	AA	R339	VRD-ST2EE102J	1K ohm	AA
R210	VRD-ST2EE272J	2.7K ohm	AA	R340	VRD-ST2EE103J	10K ohm	AA
R211	VRD-ST2EE330J	33 ohm	AA	R341	VRD-ST2EE105J	1M ohm	AA
R212	VRD-ST2EE103J	10K ohm	AA	R342	VRD-ST2EE102J	1K ohm	AA
R213	VRD-ST2EE103J	10K ohm	AA	R343	VRD-ST2EE102J	1K ohm	AA
R214	VRD-ST2EE473J	47K ohm	AA	R344	VRD-SU2EE102J	1K ohm	AA
R215	VRD-ST2EE392J	3.9K ohm	AA	R345	VRD-ST2EE102J	1K ohm	AA
R217	VRD-ST2EE183J	18K ohm	AA	R346	VRD-ST2EE104J	100K ohm	AA
R218	VRD-ST2EE153J	15K ohm	AA	R347	VRD-ST2EE473J	47K ohm	AA
R219	VRD-ST2EE561J	560 ohm	AA	R348	VRD-SU2EE104J	100K ohm	AA
R220	VRD-ST2EE102J	1K ohm	AA	R349	VRD-SU2EE154J	150K ohm	AA
R221	VRD-ST2EE681J	680 ohm	AA	R350	VRD-ST2EE103J	10K ohm	AA
R222	VRD-ST2EE222J	2.2K ohm	AA	R351	VRD-SU2EE104J	100K ohm	AA
R223	VRD-ST2EE332J	3.3K ohm	AA	R352	VRD-ST2EE123J	12K ohm	AA
R224	VRD-SU2EE683J	68K ohm	AA	R353	VRD-ST2EE682J	6.8K ohm	AA
R226	VRD-ST2EE684J	680K ohm	AA	R401	VRD-ST2EE104J	100K ohm	AA
R227	VRD-ST2EE104J	100K ohm	AA	R404	VRD-SU2EE104J	100K ohm	AA
R228	VRD-ST2EE104J	100K ohm	AA	R405	VRD-SU2EE104J	100K ohm	AA
R229	VRD-ST2EE102J	1K ohm	AA	R406	VRD-SU2EE104J	100K ohm	AA
R230	VRD-ST2EE684J	680K ohm	AA	R407	VRD-SU2EE104J	100K ohm	AA
R231	VRD-SU2EE103J	10K ohm	AA	R408	VRD-SU2EE104J	100K ohm	AA
R232	VRD-ST2EE151J	150 ohm	AA	R411	VRD-SU2EE104J	100K ohm	AA
R233	VRD-SU2EE101J	100 ohm	AA	R412	VRD-SU2EE472J	4.7K ohm	AA
R234	VRD-ST2EE221J	220 ohm	AA	R413	VRD-ST2EE222J	2.2K ohm	AA
R235	VRD-SU2EE390J	39 ohm	AA	R414	VRD-SU2EE104J	100K ohm	AA
⚠R236	VRD-ST2HD680J	68 ohm, 1/2W, ±5%, Carbon	AA	R415	VRD-ST2EE103J	10K ohm	AA
R256	VRD-ST2EE181J	180 ohm	AA	R416	VRD-ST2EE103J	10K ohm	AA
R300	VRD-ST2EE562J	5.6K ohm	AA	R417	VRD-ST2EE103J	10K ohm	AA
R302	VRD-ST2EE563J	56K ohm	AA	R418	VRD-SU2EE123J	12K ohm	AA
R303	VRD-ST2EE563J	56K ohm	AA	R419	VRD-SU2EE223J	22K ohm	AA
R304	VRD-ST2EE123J	12K ohm	AA	R420	VRD-SU2EE104J	100K ohm	AA
R305	VRD-ST2EE182J	1.8K ohm	AA	R421	VRD-SU2EE472J	4.7K ohm	AA
R306	VRD-ST2EE101J	100 ohm	AA	R500	VRD-ST2EE104J	100K ohm	AA
R307	VRD-ST2EE473J	47K ohm	AA	R501	VRD-SU2EE104J	100K ohm	AA
R308	VRD-ST2EE272J	2.7K ohm	AA	R502	VRD-ST2EE104J	100K ohm	AA
R309	VRD-SU2EE683J	68K ohm	AA	R503	VRD-ST2EE393J	39K ohm	AA
R310	VRD-ST2EE333J	33K ohm	AA	R504	VRD-ST2EE104J	100K ohm	AA
R311	VRD-SU2EE102J	1K ohm	AA	R505	VRD-ST2EE104J	100K ohm	AA
R312	VRD-SU2EE104J	100K ohm	AA	R506	VRD-ST2EE104J	100K ohm	AA
R313	VRD-ST2EE104J	100K ohm	AA	R507	VRD-ST2EE104J	100K ohm	AA
R314	VRD-SU2EE153J	15K ohm	AA	R508	VRD-ST2EE473J	47K ohm	AA
R315	VRD-SU2EE333J	33K ohm	AA	R509	VRD-ST2EE561J	560 ohm	AA
R316	VRD-ST2EE104J	100K ohm	AA	R510	VRD-ST2EE220J	22 ohm	AA
R318	VRD-ST2EE154J	150K ohm	AA	R511	VRD-ST2EE222J	2.2K ohm	AA
R319	VRD-SU2EE123J	12K ohm	AA	R512	VRD-ST2EE220J	22 ohm	AA
R320	VRD-ST2EE104J	100K ohm	AA	R513	VRD-ST2EE223J	22K ohm	AA
R321	VRD-ST2EE562J	5.6K ohm	AA	R514	VRD-ST2EE332J	3.3K ohm	AA
R322	VRD-ST2EE102J	1K ohm	AA	R518	VRD-ST2EE104J	100K ohm	AA
R323	VRD-ST2EE183J	18K ohm	AA	R519	VRD-ST2EE104J	100K ohm	AA
R324	VRD-ST2EE473J	47K ohm	AA	R520	VRD-ST2EE331J	330 ohm	AA
R325	VRD-ST2EE392J	3.9K ohm	AA	R521	VRD-ST2EE331J	330 ohm	AA
R326	VRD-ST2EE183J	18K ohm	AA	R522	VRD-ST2EE222J	2.2K ohm	AA
R327	VRD-ST2EE392J	3.9K ohm	AA	R523	VRD-ST2EE221J	220 ohm	AA
R328	VRD-ST2EE473J	47K ohm	AA	R524	VRD-ST2EE392J	3.9K ohm	AA
⚠R329	VRD-ST2HD680J	68 ohm, 1/2W, ±5%, Carbon	AA	R525	VRD-ST2EE181J	180 ohm	AA
R330	VRD-ST2EE683J	68K ohm	AA	R526	VRD-SU2EE104J	100K ohm	AA
R331	VRD-ST2EE103J	10K ohm	AA	R527	VRD-SU2EE104J	100K ohm	AA
R332	VRD-ST2EE472J	4.7K ohm	AA	R528	VRD-ST2EE563J	56K ohm	AA
R333	VRD-ST2EE472J	4.7K ohm	AA	R529	VRD-ST2EE153J	15K ohm	AA
R334	VRD-ST2EE105J	1M ohm	AA	R530	VRD-ST2EE473J	47K ohm	AA
R335	VRD-ST2EE472J	4.7K ohm	AA	R531	VRD-SU2EE103J	10K ohm	AA
R336	VRD-ST2EE153J	15K ohm	AA	R532	VRD-SU2EE103J	10K ohm	AA
R337	VRD-ST2EE104J	100K ohm	AA	R533	VRD-SU2EE104J	100K ohm	AA
R338	VRD-ST2EE102J	1K ohm	AA	R600	VRD-ST2EE222J	2.2K ohm	AA

PARTS LIST

REF. NO.	PART NO.	DESCRIPTION	CODE
R601	VRD-ST2EE122J	1.2K ohm	AA
R602	VRD-SU2EE122J	1.2K ohm	AA
R603	VRD-SU2EE150J	15 ohm	AA
R604	VRD-SU2EE150J	15 ohm	AA
R605	VRD-ST2EE564J	560K ohm	AA
R606	VRD-ST2EE105J	1M ohm	AA
R607	VRD-ST2EE471J	470 ohm	AA
R608	VRD-SU2EE332J	3.3K ohm	AA
R609	VRD-SU2EE152J	1.5K ohm	AA
R610	VRD-ST2EE222J	2.2K ohm	AA
R611	VRD-ST2EE222J	2.2K ohm	AA
R612	VRD-ST2EE471J	470 ohm	AA
R613	VRS-PU3AB101K	100 ohm, 1W, ±10%, Oxide Film	AA
R614	VRS-PU3AB101K	100 ohm, 1W, ±10%, Oxide Film	AA
R616	VRD-SU2EE821J	820 ohm	AA
R617	VRD-ST2EE562J	5.6K ohm	AA
R618	VRD-ST2EE8R2J	8.2 ohm	AA
R620	VRD-SU2EE103J	10K ohm	AA
R621	VRD-ST2EE472J	4.7K ohm	AA
R622	VRD-SU2EE222J	2.2K ohm	AA
R623	VRD-SU2EE333J	33K ohm	AA
R624	VRD-SU2EE333J	33K ohm	AA
R625	VRD-SU2EE684J	680K ohm	AA
R626	VRD-ST2EE123J	12K ohm	AA
R627	VRD-ST2EE333J	33K ohm	AA
R628	VRD-ST2EE472J	4.7K ohm	AA
R629	VRD-SU2EE104J	100K ohm	AA
R700	VRD-ST2EE101J	100 ohm	AA
R701	VRD-ST2EE101J	100 ohm	AA
R702	VRD-ST2EE101J	100 ohm	AA
R703	VRD-ST2EE101J	100 ohm	AA
R704	VRD-ST2EE332J	3.3K ohm	AA
R705	VRD-ST2EE561J	560 ohm	AA
R706	VRD-ST2EE561J	560 ohm	AA
R707	VRD-ST2EE104J	100K ohm	AA
R708	VRD-ST2EE181J	180 ohm	AA
R800	VRD-ST2EE103J	10K ohm	AA
R801	VRD-ST2EE153J	15K ohm	AA
R900	VRD-ST2EE104J	100K ohm	AA
R901	VRD-ST2EE104J	100K ohm	AA
R902	VRD-ST2EE104J	100K ohm	AA
R903	VRD-ST2EE104J	100K ohm	AA
R904	VRD-ST2EE104J	100K ohm	AA

RESISTORS ARRAY

REF. NO.	PART NO.	DESCRIPTION	CODE
RA400	RMPTC0034AFZZ	4.7K ohm x 9, 1/8W, ±10%	AC
RA700	RMPTC0015AFZZ	100K ohm x 8, 1/8W, ±10%	AD
RA701	RMPTC0033AFZZ	100K ohm x 7, 1/8W, ±10%	AD

MISCELLANEOUS

REF. NO.	PART NO.	DESCRIPTION	CODE
	GCAB-3069AFSA	Cabinet	AV
	GCOVA1202AFSB	Cover, Tuning Frequency and Band Display/Signal Strength Indicator/FM Stereo Broadcast Indicator	AK
	GCOVA1223AFSA	Cover, Function Indicators (LED x 6)	AF
	GCOVA1224AFSA	Cover, Function Indicators (LED x 11)	AE
	GCOVH1161AFSA	Cover, MW/LW Ferrite Bar Antenna	AF
	GFTAU3096AFZZ	Bottom Plate	AP
	GLEGP0065AF00	Leg, Outer (Large)	AB
	GLEGP0066AF00	Leg, Inner (Small)	AA
	HPNLC3451AFSA	Front Panel (ST-5200H)	BE
	GMADM0009AFSA	Window, Tuning Frequency and Band Display/Signal Strength Indicator/FM Stereo Broadcast Indicator	AN
	GMADZ0066AFSA	Window, Function Indicators (LED x 17)	AN
	HINDM1437AFSA	Indication Metal, Tuning Knob	AE
	PSPAS0080AFSA	Spacer, Power Switch Knob	AB
	PSPAZ0090AFSA	Spacer, Push Switch, Knob	AA
	PSPAZ0091AFSA	Spacer, Tuning Knob	AC
	HPNLC3451AFSB	Front Panel (ST-5200HB)	AE
	GMADM0009AFSA	Window, Tuning Frequency and Band Display/Signal Strength Indicator/FM Stereo Broadcast Indicator	AN
	GMADZ0066AFSA	Window, Function Indicators (LED x 17)	AN
	HINDM1437AFSB	Indication Metal, Tuning Knob	AE
	PSPAS0080AFSB	Spacer, Power Switch Knob	AB
	PSPAZ0090AFSB	Spacer, Push Switch Knob	AA
	PSPAZ0091AFSB	Spacer, Tuning Push Knob	AC
	JKNBM0297AFSA	Knob, Power ON/OFF Switch (ST-5200H)	AD
	JKNBM0297AFSB	Knob, Power ON/OFF Switch (ST-5200HB)	AD
	JKNBZ0200AFSA	Knob, FM Aircheck/FM High Blend/FM Stereo (Muting)/FM Mono/MW/LW/Pre-Set Station Memory/Input-Pre-Setting (0 ~ 9)/Frequency Count-up/Automatic Tuning/Frequency Count down (ST-5200H)	AC
	JKNBZ0200AFSB	Knob, FM Aircheck/FM High Blend/FM Stereo (Muting)/FM Mono/MW/LW/Pre-Set Station Memory/Input-Pre-Setting (0 ~ 9)/Frequency Count-up/Automatic Tuning/Frequency Count down (ST-5200HB)	AD
	LANGF0481AFZZ	Bracket, Left Hand Side and Right Hand Side, Chassis	AE
	LANGF0585AFZZ	Bracket, Main P.W. Board Retaining	AA
	LANGG0077AFZZ	Lever, Power ON/OFF Switch	AD
	LANGK0256AFZZ	Bracket, MW/LW Ferrite Bar Antenna Cover	AD
	LANGQ0652AFZZ	Bracket, Power ON/OFF Switch	AB
	LANGQ0786AFSA	Rear Panel (ST-5200H)	AN
	LANGQ0787AFSA	Rear Panel (ST-5200HB)	AN
	LANGR0510AFZZ	Bracket, Power Transformer	AC
	LANGR0511AFZZ	Bracket, Front Panel, Chassis	AL
	LANGT0790AFZZ	Bracket, Main P.W. Board Retaining	AE
	LANGZ0081AFZZ	Shield Case Earth Conductor Plate	AA
	LHLDF1266AFZZ	Holder, P.W. Board	AB
	LHLDW1075AFZZ	Wire Holder, 60 mm	AA

PARTS LIST

REF. NO.	PART NO.	DESCRIPTION	CODE
	LHLDW9003CEZZ	Wire Holder	AA
	LHLDZ1120AFZZ	Holder, LED	AB
	LX-BZ0261AFFD	Screw (Special), Front Panel Retaining	AA
	LX-HZ0051AFFD	Screw with Washer, P.W.B. Retaining	AA
	LX-LZ0051AF00	Push Rivet, Nylon, 3.5mm Dia	AA
	PCASB0058AFZZ	Battery Case	AG
	PCASB0059AFZZ	Battery Cover	AF
	PCOVW1110AFZZ	Insulation Cover, AC Power Supply Cord Lug	AB
	PCUSG0123AF00	Cushion, Rear Panel	AA
	PFILW0026AFSA	Optical Filter, Tuning Band and Frequency Display	AD
	PFLT-0330AF00	Felt, Cabinet	AA
	PGUMM0139AF00	Cushion (Rubber), Leg	AA
	PSLDM3183AFZZ	Shield Case, FM RF Circuit, (Middle)	AB
	PSLDM3184AFZZ	Shield Case, FM RF Circuit, (Small)	AB
	PSLDM3185AFZZ	Shield Case, P.L.L. Frequency Synthesizer Circuit (Large)	AD
	PSLDM3192AFZZ	Shield Plate, FM RF Circuit (Middle)	AB
	PSLDM3193AFZZ	Shield Plate, P.L.L. Frequency Synthesizer Circuit (Large)	AB
	PSLDM3198AFZZ	Shield Plate, Synthesizer Circuit (Small)	
	PSPAB0103AFFW	Spacer, AC Voltage Selector Switch	AA
CNS700	QCNCW322DAFZZ	Connecting Socket, 4-Pin	AB
	QCNW-0279AFZZ	Connecting Wires, RCA-Pin, Type Accessory	AK
CNW101	QCNW-0904AFZZ	Connecting Wires x 4	AD
CNW103	QCNW-0906AFZZ	Connecting Wires x 5	AC
CNW104	QCNW-0907AFZZ	Connecting Wires x 6	AC
CNW105	QCNW-0907AFZZ	Connecting Wires x 6	AC
CNW106	QCNW-0908AFZZ	Connecting Wires x 4	AB
CNW107	QCNW-0915AFZZ	Connecting Wires x 7	AD
CNW108	QCNW-0915AFZZ	Connecting Wires x 7	AD
CNW109	QCNW-0909AFZZ	Connecting Wires x 4	AD
CNW110	QCNW-0916AFZZ	Connecting Wires x 4	AB
CNW111	QCNW-0912AFZZ	Connecting Wires x 5	AB
CNW112	QCNW-0913AFZZ	Connecting Wires x 3	AB
CNW113	QCNW-0914AFZZ	Connecting Wires x 4	AB
CNW114	QCNW-0869AFZZ	Connecting Wires x 10	AC
CNW115	QCNW-0905AFZZ	Connecting Wires x 10	AD
CNW201	QCNW-0910AFZZ	Connecting Wires x 4	AB
CNW202	QCNW-0911AFZZ	Connecting Wires x 6	AC
	QLUGL0451AFZZ	Terminal Strip, 4-Lug, AC Power Supply Cord	AD
SO402	QSOCJ0270AFZZ	Socket, (RCA Type) 2 Pin	AD
SO701	QSOCZ2179AFZZ	Socket, 75 ohm	AE
SO701	QSOCZ2177AFZZ	Socket, 75 ohm (For UK Only)	AF
⚠SW-601	QSOCE0558AFZZ	Switch, Voltage Selector	
SW-700	QSW-K0050AFZZ	Switch, Input/Pre-Setting, 0	AC
SW-701	QSW-K0050AFZZ	Switch, Input/Pre-Setting, 1	AC
SW-702	QSW-K0050AFZZ	Switch, Input/Pre-Setting, 2	AC
SW-703	QSW-K0050AFZZ	Switch, Input/Pre-Setting, 3	AC
SW-704	QSW-K0050AFZZ	Switch, Input/Pre-Setting, 4	AC
SW-705	QSW-K0050AFZZ	Switch, Input/Pre-Setting, 5	AC

REF. NO.	PART NO.	DESCRIPTION	CODE
SW-706	QSW-K0050AFZZ	Switch, Input/Pre-Setting, 6	AC
SW-707	QSW-K0050AFZZ	Switch, Input/Pre-Setting, 7	AC
SW-708	QSW-K0050AFZZ	Switch, Input/Pre-Setting, 8	AC
SW-709	QSW-K0050AFZZ	Switch, Input/Pre-Setting, 9	AC
SW-710	QSW-K0050AFZZ	Switch, Pre-Set Station Memory	AC
SW-711	QSW-K0050AFZZ	Switch, Frequency Count-down	AC
SW-712	QSW-K0050AFZZ	Switch, Automatic Tuning	AC
SW-713	QSW-K0050AFZZ	Switch, Frequency Count-up	AC
SW-800	QSW-K0050AFZZ	Switch, High Blend	AC
SW-801	QSW-K0050AFZZ	Switch, FM Air Check	AC
SW-802	QSW-K0050AFZZ	Switch, Wave Band Selector, LW	AC
SW-803	QSW-K0050AFZZ	Switch, Wave Band Selector, MW	AC
SW-804	QSW-K0050AFZZ	Switch, Wave Band Selector, FM Mono	AC
SW-805	QSW-K0050AFZZ	Switch, Wave Band Selector, FM Stereo (Muting)	AC
⚠SW-600	QSW-P0275AFZZ	Switch, Power	AE
TM100	QTANN0463AFZZ	Antenna Terminals, FM (300 ohm) and MW/LW	AF
	QANTW0051AFZZ	FM Indoor Antenna, T-Shape	AG
	SPAKA0713AFZZ	Packing Add, Left Side	AE
	SPAKA0714AFZZ	Packing Add, Right Side	AE
	SPAKC1564AFZZ	Packing Case (ST-5200H)	AL
	SPAKC1565AFZZ	Packing Case (ST-5200HB)	AL
	SSAKA0024AFZZ	Polyethylene Bag, Operation Manual	AA
	SSAKH0156AFZZ	Polyethylene Bag, Set	AC
	TCAUA0215AFZZ	Caution Label, Battery Cover	AC
	TCADN0050AFZZ	Registration Card (For UK Only)	AA
	TCAUH0187AFZZ	Caution Label, Antenna Cover	
	TCAUH0056AGZZ	Caution Label, A.C. Cord (For UK Only)	
	TCAUS0076AFZZ	Caution Label, Bottom Plate	
	TCAUZ0039AFZZ	Caution Label, Bag for Set (For UK Only)	
	TINSZ0247AFZZ	Operation Manual	AH
	TTAGH0142AFZZ	Tag	
	UBATU0008AGZZ	Battery	AC
V700	VVK7-MT-13ZS1	Fluorescence Dispplay Tube (Tuning Frequency Display)	AX
	⚠ LBSHC0002AGZZ	Bushing, AC Supply Cord	AB
	⚠ LBSHC0004AGZZ	Bushing, AC Supply Cord	AB
	⚠ LBSHC0007AFZZ	Bushing, AC Supply Cord	AB
	⚠ QACCB0052AF09	AC Supply Cord	AH
	⚠ QACCL0001AFZZ	AC Supply Cord	AL
	⚠ QACCV0001AGZZ	AC Supply Cord	AL
	⚠ QACCZ0002TA0F	AC Supply Cord	AG
	⚠ QACCZ0053AF00	AC Supply Cord	AK

P.W.B. ASSEMBLY

(Not Replacement Item)

REF. NO.	PART NO.	DESCRIPTION	CODE
	DUNTR0156AF03 (Combined Assembly)	Power Supply/Linear/Frequency Display Digital/Main Digital Circuit	

Note: D200, D201, D202
For ordering this assembly of three diodes, a separate supply of each diode is not possible: the three are considered a pair.

SHARP OPTONICA

TECHNICAL GUIDE

Refer to the additional issue "SERVICE MANUAL

ELECTRONIC TUNING PROCESSOR

MODEL

ST-5200H
(Silver Panel)

ST-5200HB
(Brown Panel)

(PHOTO: ST-5200H)

+ 3288

In the interests of user-safety the set should be restored to its original condition and only parts identical to those specified be used.

INDEX TO CONTENTS

1. SPECIFICATIONS 2
2. DATAGRAPH .... 2 ~ 3
3. CAUTIONS ON SERVICING 4
4. FRONT PARTS AND REAR PARTS LAYOUT .... 5 ~ 6
5. BLOCK DIAGRAM .... 7 ~ 8

6. CIRCUIT DESCRIPTION

FM RF CIRCUIT 9
FM AGC 9
ELECTRONIC ATTENUATOR CIRCUIT 9
FM IF CIRCUIT 9
FM DETECTION CIRCUIT 10
MUTING CIRCUIT 10
LOW-PASS FILTER 11
ACTIVE LOW-PASS FILTER 11
P.L.L. MULTIPLEX STEREO DEMODULATOR 11
AIR CHECK CALIBRATOR CIRCUIT 12
MW/LW TUNER CIRCUIT 12
AIR CHECK ON/OFF CIRCUIT 13
SELECTOR CIRCUIT 13
STEREO/MONO SELECTOR CIRCUIT 13
HIGH BLEND CIRCUIT 14
LED INDICATOR 14
SIGNAL INDICATOR CIRCUIT 14
FREQUENCY INDICATOR CIRCUIT 14
BAND INDICATOR CIRCUIT 15
DISPLAY CIRCUIT 15
POWER SUPPLY CIRCUIT 16
P.L.L. SYNTHESIZER .... 18 ~ 23
P.L.L. FREQUENCY SYNTHESIZER SYSTEM .... 24 ~ 25

7. ALIGNMENT INSTRUCTIONS

REQUIRED EQUIPMENT 26
AM IF ALIGNMENT (MW, LW) 27
LW RF ALIGNMENT 27
MW RF ALIGNMENT 28
FM IF/RF ALIGNMENT 29
FM IF READJUSTMENT AND DISTORTION FACTOR ADJUSTMENT 31
ADJUSTMENT OF AIR CHECK CAL 31
ADJUSTMENT OF FM MUTING LEVEL 31
ADJUSTMENT OF V.C.O./SEPARATION 31
ADJUSTMENT OF FM STEREO V.C.O. FREE-RUNNING FREQUENCY, DISTORTION FACTOR AND STEREO SEPARATION 32
8. VOLTAGES ON POSITION .... 32 ~ 33
9. EQUIVALENT CIRCUIT OR BLOCK DIAGRAM OF INTEGRATED CIRCUIT .... 33 ~ 36
10. TRANSISTORS, DIODES, LEDS TYPES 37
11. PACKING METHOD (UK only) 38

SHARP CORPORATION OSAKA, JAPAN

SPECIFICATIONS

GENERAL DESCRIPTION

Power Source:	AC 110/220/240 V, 50/60 Hz
Power Consumption:	15 W
Semiconductors:	1-Microprocessor 12-ICs (Integrated Circuit) 1-FET (Dual Gate, MOS type) 3-FETs (Junction type) 55-Transistors 75-Diodes (With 7-variable capacitance diodes) 6-Zener Diodes 18-LEDs and 1-LED Array Unit
Dimensions:	Width; 430 mm (16-15/16 inches) Height; 75 mm (2-31/32 inches) Depth; 393 mm (15- 1/ 2 inches) Weight; 5 kg (11 lbs)

FM

Tuning Range:	87,6 to 108 MHz
IF:	10.7 MHz
Scan Frequency:	50 kHz
Sensitivity:	1.3 µV (at S/N 26 dB, 40 kHz deviation, 75 ohms) 1.6 µV (at S/N 26 dB, 40 kHz deviation, 300 ohms)
Frequency Response:	30 to 15000 Hz ± 3 dB
Image Rejection:	75 dB (at 98 MHz)
IF Rejection:	75 dB (at 98 MHz)
Selectivity: (22.5 kHz deviation, ±300 kHz)	45 dB
Capture Ratio:	2.5 dB
AM Suppression:	50 dB
S/N:	66 dB
Distortion:	Mono; 0.2% Stereo; 0.3%
Stereo Separation:	40 dB (at 1 kHz)
FM Output Voltage:	350 mV (40 kHz deviation)

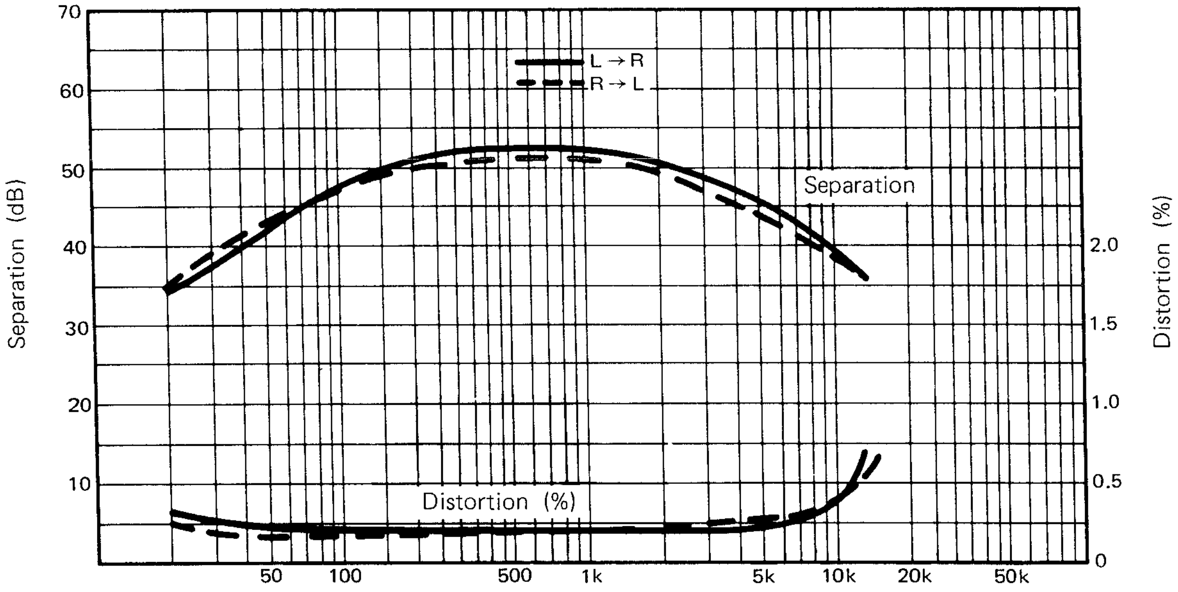
MW/LW

Tuning range:	MW;	522 ~ 1611 kHz
	LW;	145 ~ 372 kHz
IF:	450 kHz	
Scan Frequency:	1 kHz (Manual Tuning) 9 kHz (Automatic Tuning)	
Quieting Sensitivity:	MW;	350 µV/m
	LW;	350 µV/m
Image Rejection:	MW;	40 dB (at 1000 kHz)
	LW;	35 dB (at 340 kHz)
IF Rejection:	MW;	40 dB (at 1000 kHz)
	LW;	32 dB (at 340 kHz)
Distortion:	1.5%	
Output Voltage:	200 mV (400 Hz, 30% Modulation)	

Specifications are subject to change without prior notice.

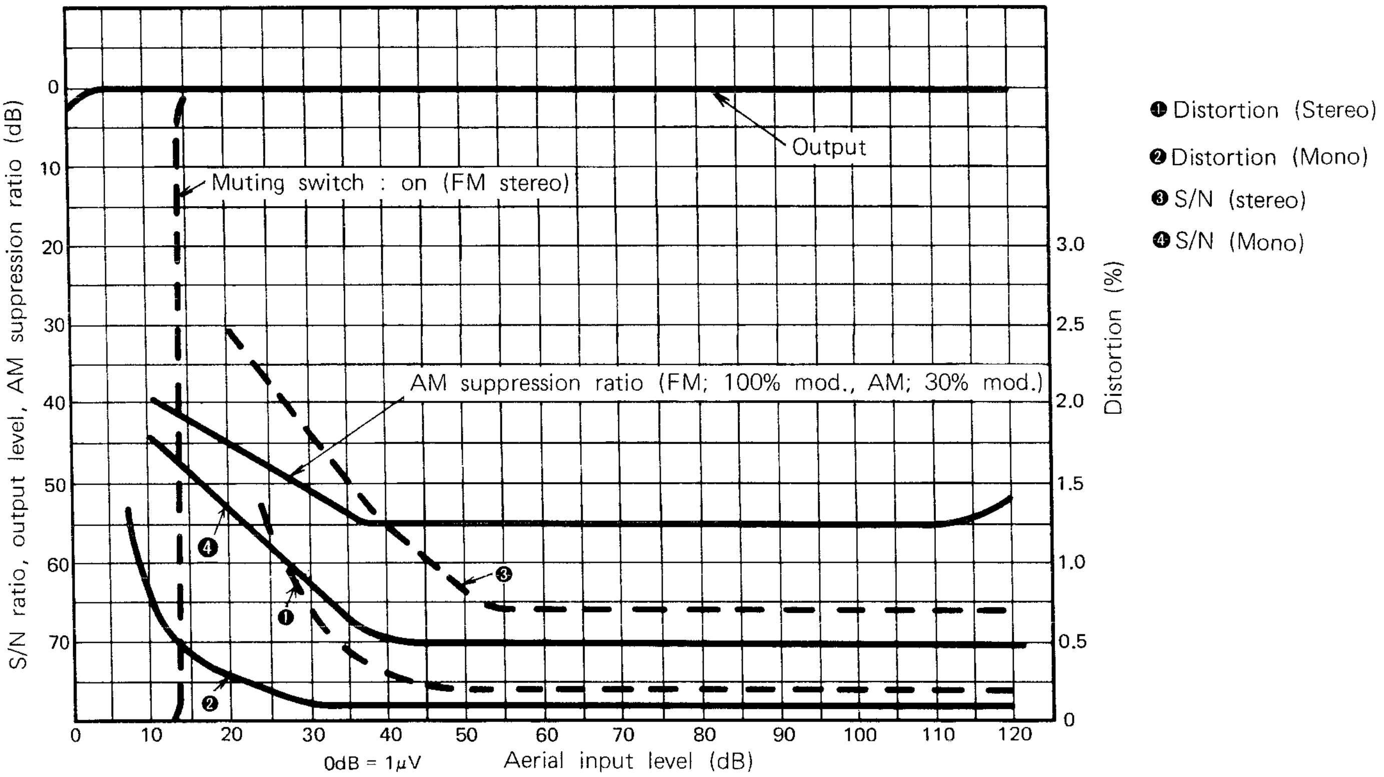
DATAGRAPH

Frequency vs Separation characteristic, Distortion characteristic.



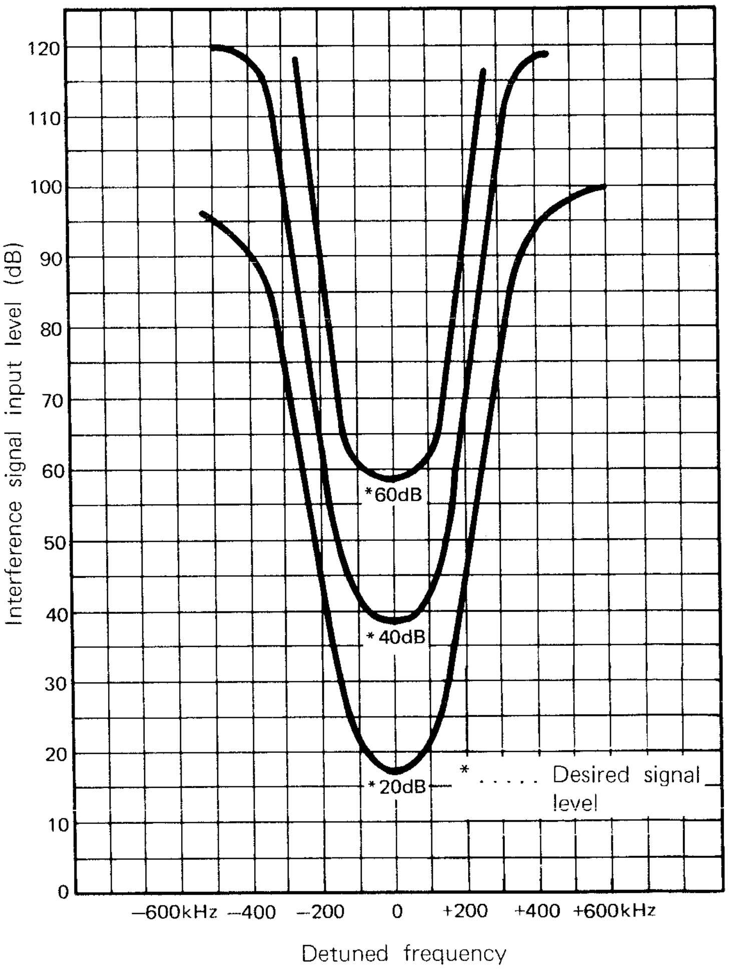
Reception frequency:	98MHz
Dummy aerial:	300 ohms, balanced
Modulation frequency:	
PILOT;	6kHz deviation
L+R;	20kHz deviation
L–R;	20kHz deviation
Aerial input:	60dB

FM input vs FM output characteristic, S/N ratio characteristic, Distortion characteristic, AM suppression ratio characteristic.



Reception frequency: 98MHz
Modulation frequency:
Mono; 1kHz (40kHz deviation)
Stereo; 1kHz
PILOT; 6kHz deviation
L + R; 20kHz deviation
L − R; 20kHz deviation
Dummy aerial: 300 ohm, balanced
Output voltage: 350mV

FM effective selectivity characteristic



Interference signal: 1kHz, 22.5kHz deviation
Dummy aerial: 300 ohms, balanced
Reception frequency: 98MHz

CAUTIONS ON SERVICING

As far as the AC power supply cord is plugged into AC outlet, even if the power switch is set at "OFF" position there still remian voltages not only at the power supply circuit but also in other electrical sections of the unit; so be sure to remove the AC power supply cord from the outlet prior to any repair works.
Connection cables from the front PWB and main PWB must all be put under the chassis.

Battery Installation

The batteries serve as power source for the microprocessor, memory and frequency display protection during A.C. supply failure or disconnection. Battery should be fitted before connecting plug to A.C. supply.

1. Remove cover from battery compartment.
2. Place four UM/SUM-3, or four AA, or HP-7 in the Battery Compartment. Check for a clean contacts and correct polarity.
3. Replace cover.
4. Renew batteries every 12 months.

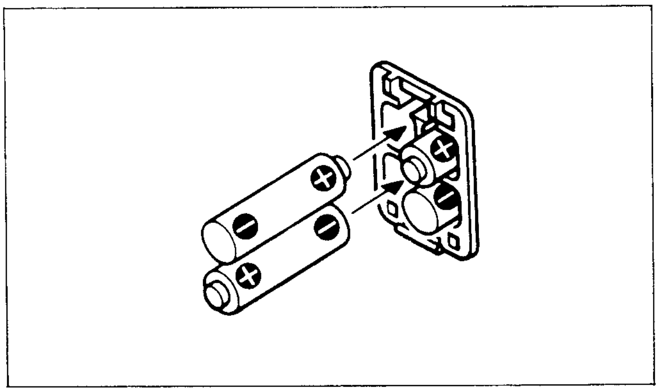


Figure 4–2

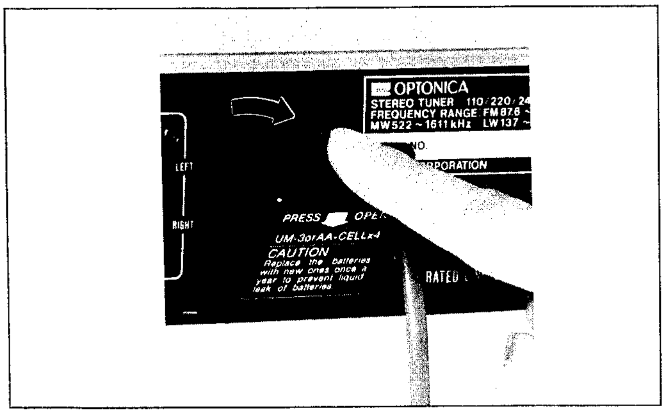

OPTONICA
STEREO TUNER 110/220/2
FREQUENCY RANGE FM87.6
MW522 ~ 1611kHz LW137
LEFT
RIGHT
PRESS OPE
UM-3orAA-CELLx4
CAUTION
Replace the batteries with new ones once a year to prevent liquid leak of batteries.
RATED

Figure 4–1

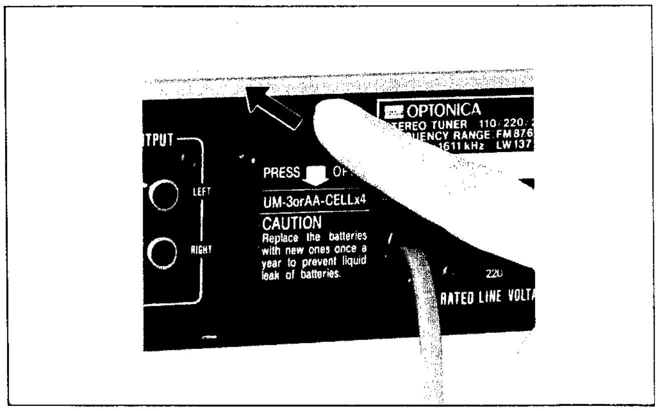

OPTONICA
LEFT
RIGHT
PRESS
UM-3orAA-CELLx4
CAUTION
Replace the batteries with new ones once a year to prevent liquid leak of batteries.
220
RATED LINE VOLT

Figure 4–3

FRONT PARTS AND REAR PARTS LAYOUT

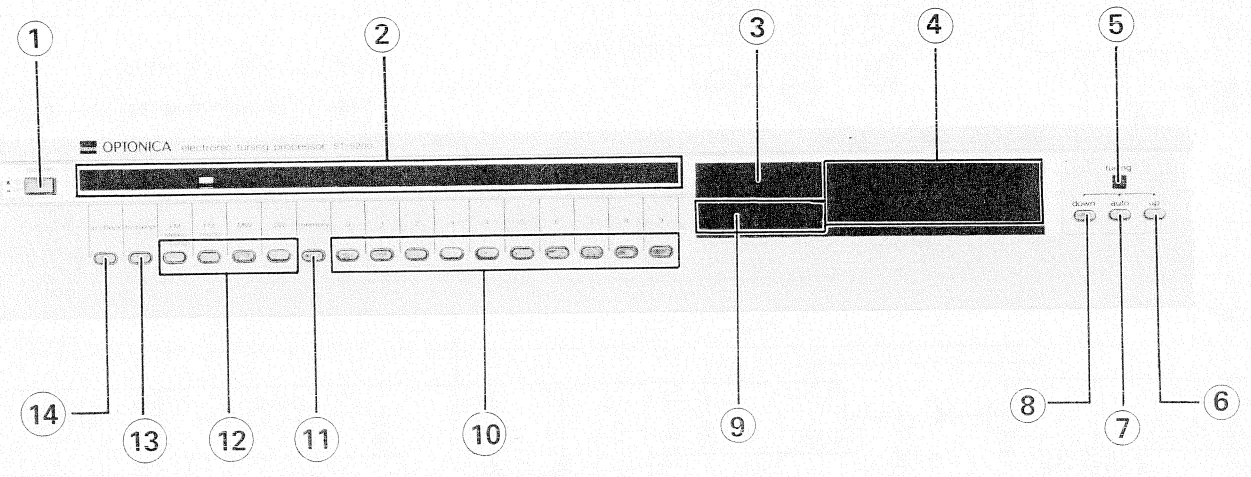


Figure 5-1

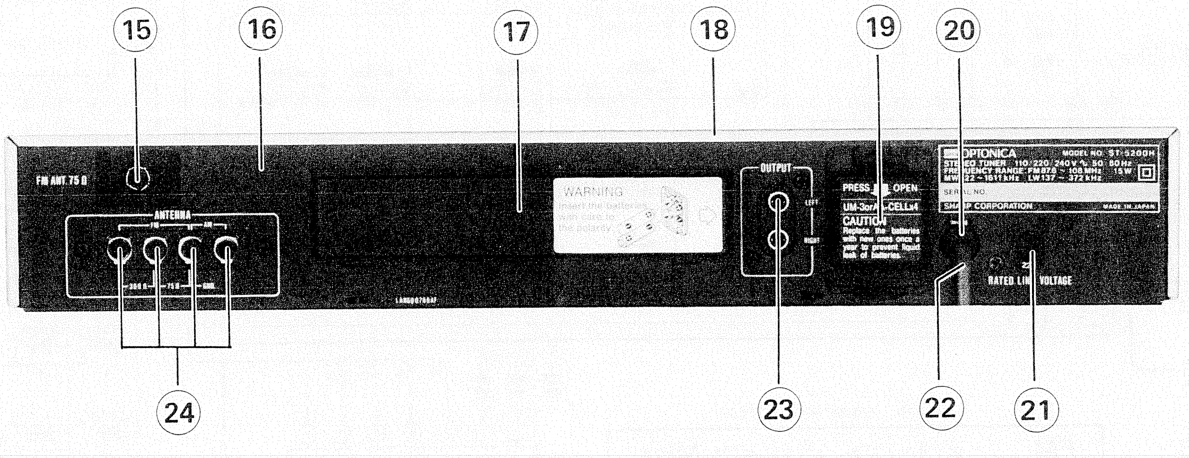


Figure 5-2

FRONT PARTS LAYOUT

① Power ON/OFF Switch Knob (ST-5200H JKNBM0297AFSA, ST-5200HB JKNBM0297AFSB)
② Function Indicators (17, LED) (VHPGL-9NG12-1)
③ FM Stereo Broadcast Indicator (LED Array, VHPSEL8820A1F)
④ Tuning Frequency and Band Display (VVK7-MT-13ZS1)
⑤ Automatic Tuning Mode Indicator (VHPGL-9PR4X-1)
⑥ Frequency Count-up Switch Knob (ST-5200H JKNBZ0200AFSA, ST-5200HB JKNBZ0200AFSB)
⑦ Automatic Tuning Switch Knob (ST-5200H JKNBZ0200AFSA, ST-5200HB JKNBZ0200AFSB)
⑧ Frequency Count-down Switch Knob (ST-5200H JKNBZ0200AFSA, ST-5200HB JKNBZ0200AFSB)
⑨ Signal Strength Indicator (LED Array, VHPSEL8820A1F)
⑩ Input-Pre-setting Switch Knob (ST-5200H JKNBZ0200AFSA, ST-5200HB JKNBZ0200AFSB)
⑪ Pre-set Station Memory Switch Knob (ST-5200H JKNBZ0200AFSA, ST-5200HB JKNBZ0200AFSB)
⑫ Wave Band Selector (FM stereo/FM mono/LW/MW) Switch Knob (ST-5200H JKNBZ0200AFSA, ST-5200HB JKNBZ0200AFSB)
⑬ High Blend Switch Knob (ST-5200H JKNBZ0200AFSA, ST-5200HB JKNBZ0200AFSB)
⑭ FM Air Check Switch Knob (ST-5200H JKNBZ0200AFSA, ST-5200HB JKNBZ0200AFSB)

REAR PARTS LAYOUT

⑮ DIN 45 325 Type (or UK Standard Type) FM Co-axial Antenna (75 ohm Unbalanced) Socket (QSOCZ2179AFZZ/QSOCZ2177AFZZ ...... UK only)
⑯ Rear Panel (ST-5200H LANGQ0786AFSA, ST-5200HB LANGQ0787AFSA)
⑰ MW/LW Ferrite Bar Antenna Cover (GCOVH1161AFSA)
⑱ Cabinet (GCAB-3069AFSA)
⑲ Battery Compartment Cover (PCASB0059AFZZ)
⑳ Bushing, AC Power Supply Cord
㉑ AC Voltage Selector Socket (QSOCE0558AFZZ)
㉒ AC Power Supply Cord
㉓ Output Sockets (QSOCJ0270AFZZ)
㉔ Antenna Terminals, FM (75 ohm and 300 ohm) and MW/LW External (QTANN0463AFZZ)

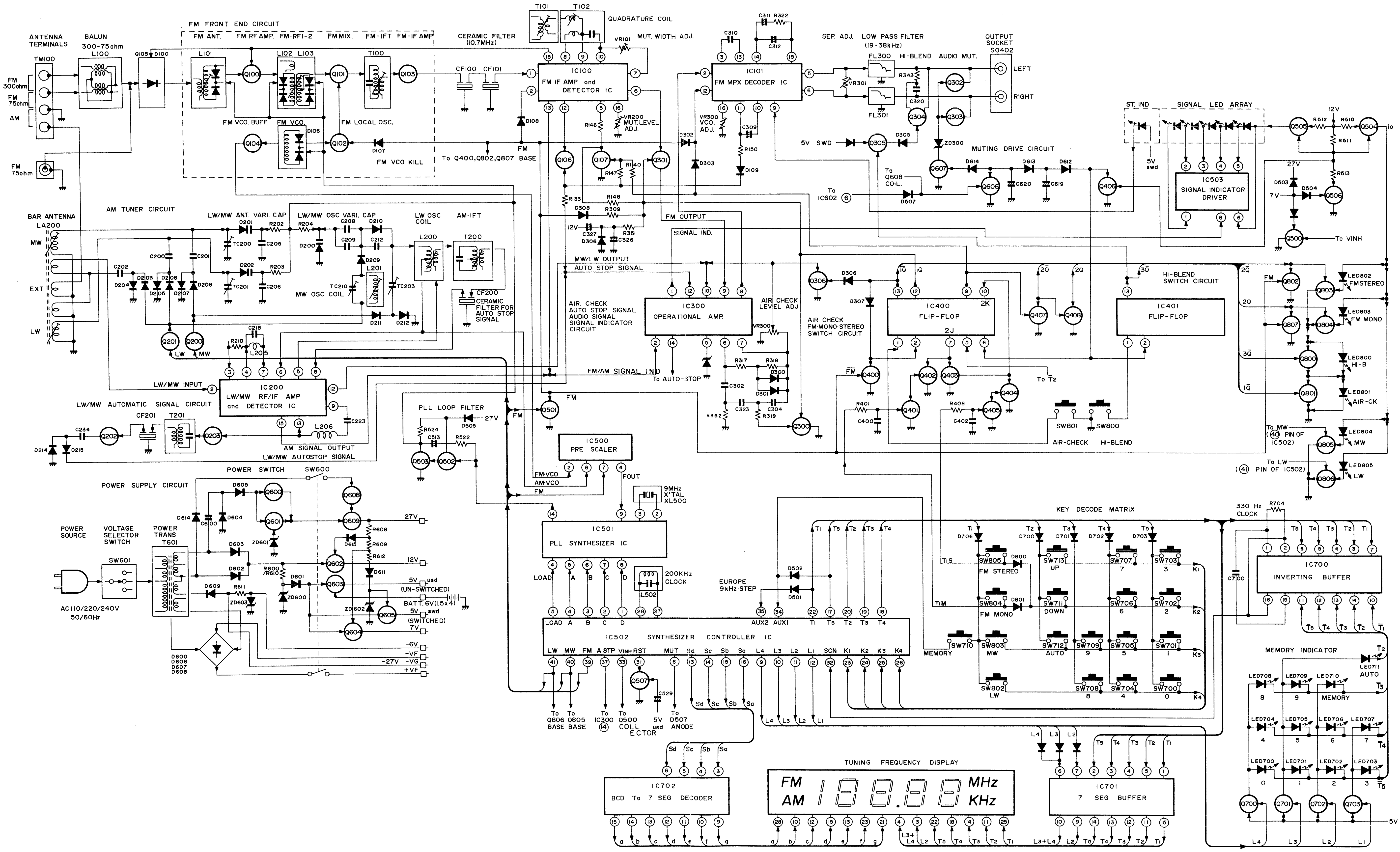

ANTENNA TERMINALS
TM100
FM 300ohm
FM 75ohm
AM
BALUN 300-75ohm L100
FM 75ohm
FM FRONT END CIRCUIT
FM ANT.
FM RF AMP.
FM-RFI-2
FM MIX.
FM-IFT FM-IF AMP
L101
L102 L103
T100
Q100
Q101
Q103
Q104
Q102
FM VCO. BUFF.
FM VCO.
FM LOCAL OSC.
FM VCO KILL
CERAMIC FILTER (10.7MHz)
CF100 CF101
T101 T102
QUADRATURE COIL
VR101 MUT. WIDTH ADJ.
IC100
FM IF AMP and DETECTOR IC
To Q400,Q802,Q807 BASE
VR200 MUT.LEVEL ADJ.
IC101
FM MPX DECODER IC
VR300 VCO. ADJ.
SEP. ADJ.
LOW PASS FILTER (19-38kHz)
FL300
FL301
HI-BLEND
AUDIO MUT.
OUTPUT SOCKET S0402
LEFT
RIGHT
5V SWD
MUTING DRIVE CIRCUIT
To Q608 COIL.
To IC602 ⑥
ST. IND
SIGNAL LED ARRAY
12V
5V swd
IC503
SIGNAL INDICATOR DRIVER
27V
7V
To VINH
BAR ANTENNA LA200
MW
EXT
LW
AM TUNER CIRCUIT
LW/MW ANT. VARI. CAP
LW/MW OSC VARI. CAP
LW OSC COIL
AM-IFT
L200
T200
MW OSC COIL
CF200 CERAMIC FILTER FOR AUTO STOP SIGNAL
Q201
Q200
LW
MW
FM OUTPUT
SIGNAL IND.
MW/LW OUTPUT
AUTO STOP SIGNAL
AIR. CHECK AUTO STOP SIGNAL AUDIO SIGNAL SIGNAL INDICATOR CIRCUIT
IC300
OPERATIONAL AMP.
AIR CHECK LEVEL ADJ
AIR CHECK FM-MONO-STEREO SWITCH CIRCUIT
IC400
FLIP-FLOP
IC401
FLIP-FLOP
HI-BLEND SWITCH CIRCUIT
FM/AM SIGNAL IND
To AUTO-STOP
LW/MW INPUT
IC200
LW/MW RF/IF AMP and DETECTOR IC
LW/MW AUTOMATIC SIGNAL CIRCUIT
CF201
T201
AM SIGNAL OUTPUT
LW/MW AUTOSTOP SIGNAL
PLL LOOP FILTER
IC500
PRE SCALER
FM-VCO
AM-VCO
FM
FOUT
9MHz X'TAL XL500
To T2
SW801
SW800
AIR-CHECK
HI-BLEND
LED802 FMSTEREO
LED803 FM MONO
LED800 HI-B
LED801 AIR-CK
To MW (40 PIN OF IC502)
LED804 MW
To LW (41 PIN OF IC502)
LED805 LW
POWER SWITCH
SW600
POWER SUPPLY CIRCUIT
POWER SOURCE
VOLTAGE SELECTOR SWITCH
SW601
POWER TRANS T601
AC110/220/240V 50/60Hz
27V
12V
5V usd (UN-SWITCHED)
BATT. 6V(1.5x4)
5V swd (SWITCHED)
7V
-6V
-VF
-27V -VG
+VF
D600 D606 D607 D608
IC501
PLL SYNTHESIZER IC
LOAD
200KHz CLOCK
L502
EUROPE 9kHz STEP
IC502
SYNTHESIZER CONTROLLER IC
LOAD A B C D
AUX2 AUX1
LW MW FM A STP VINH RST MUT Sd Sc Sb Sa L4 L3 L2 L1 SCN K1 K2 K3 K4
To Q806 BASE
To Q805 BASE
To IC300 ⑭
To Q500 COLLECTOR
5V usd
To D507 ANODE
KEY DECODE MATRIX
330 Hz CLOCK
SW805 FM STEREO
SW804 FM MONO
SW713 UP
SW711 DOWN
SW707 7
SW703 3
SW706 6
SW702 2
SW710 MEMORY
SW803 MW
SW712 AUTO
SW709 9
SW705 5
SW701 1
SW802 LW
SW708 8
SW704 4
SW700 0
IC700
INVERTING BUFFER
MEMORY INDICATOR
LED711 AUTO
LED708 8
LED709 9
LED710 MEMORY
LED704 4
LED705 5
LED706 6
LED707 7
LED700 0
LED701 1
LED702 2
LED703 3
Q700
Q701
Q702
Q703
5V swd
TUNING FREQUENCY DISPLAY
FM
AM
MHz
KHz
IC702
BCD To 7 SEG DECODER
IC701
7 SEG BUFFER
a b c d e f g

Figure 7 BLOCK DIAGRAM

CIRCUIT DESCRIPTION

■ FM RF CIRCUIT

FM antenna input circuit has two input terminals (75 ohms and 300 ohms). The 75 ohms input terminal is used when FM antenna is connected to the unit by using a coaxial cable. The 300 ohms input terminal is used when FM antenna is connected to the unit by using a balanced feeder. Figure 9–1 shows FM Front- End circuit. The front-end section consists of 1 FET (dual-gate, MOS type) and 2 transistors. Transistor Q100 is FET and its function is nearly the same as of vacuum tube. Due to the adoption of FET, crossmodulation characteristic and spurious characteristic are remarkably improved compared with conventional transistor type. (Sharp-made ones).

It is so devised that AGC voltage is applied to the gate 2 (G_2) of FET Q100 of FM Front-End circuit.....this results in that when input signal to FM antenna is strong, amplification degree of FET Q100 is lowered so as to stabilize FM reception. The voltage applied to the gate 2 (G_2) of FET Q100 is at the level of about 4.3 V when the antenna is receiving no input signal.

The voltage is decreased as the input signal to the antenna is increased and it becomes at the level of about less than 1 V when the input signal to the antenna is of 100 dB.

Therefore, the amplification degree of FET Q100 is attenuated by more than about 30 dB.

FET Q100 is FM radio frequency amplifier. Transistor Q101 works as frequency mixer, in which radio frequency signal coming from the FET Q100 and local oscillation frequency coming from the transistor Q102 are mixed to produce 10.7 MHz IF signal which will enter IF tuning transformer T100. The transistor Q102 is for the local oscillation and it applies oscillation voltage to the base of transistor Q101 via capacitor C122 (1.5PF. CH).

Therefore, coil L101 is for antenna tuning, coils L102 and L103 are for FM RF amplification and tuning and coil L104 is for local oscillation.

Meanwhile, during AM broadcast reception, it is so designed that +B voltage is applied to the emitter of the transistor Q102 via the diode D107 and resistor R121 to stop the oscillation.

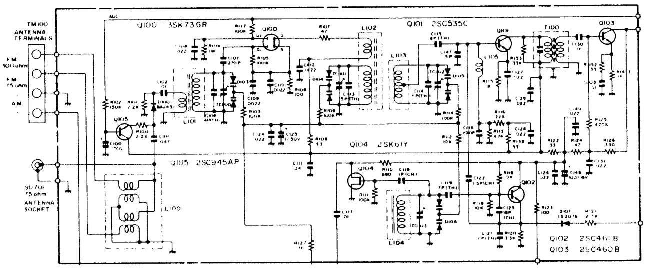

TM101 ANTENNA TERMINALS
FM 300ohm
FM 75ohm
AM
Q100 3SK73GR
Q101 2SC535C
L101
L102
L103
L104
T100
Q103
Q104 2SK61Y
Q105 2SC945AP
50 75ohm ANTENNA SOCKET
Q102 2SC461B
Q103 2SC460B

Figure 9–1

■ FM AGC

FM AGC voltage is developed at terminal ⑮ of IC100, and is applied to the gate 2 (G_2) of FET Q100 through resistor R117

The AGC voltage is developed in IC100 as delayed AGC voltage, and the AGC starts to operate when antenna input reaches approx. 60 dB and thus a voltage at terminal ⑮ of IC101 starts to drop.

■ ELECTRONIC ATTENUATOR CIRCUIT

FM signal may sometimes be at too high a level for the set to process it properly. In this case, pin ⑮ (AGC) of IC100 (FM IF amplifier) makes its own voltage fall near to 0 V so that voltage at the emitter of Q105 decreases to produce less current running through R100, D100 and R101, then the resistance of D100 increases. Meanwhile the FM signal is fed to L101 (FM antenna coil) via C101, D100 and C102, and it is at this point that the FM signal is prevented from running through C101 and C102 because of the above mentioned resistance increase of D100. This is the function of the electronic attenuator circuit.

But, when the FM signal level is not so high, there remains a voltage of about 4.6 V at pin ⑮ (AGC) of IC100 and the emitter of Q105 is kept at about 4 V.

D100 is thus allowed enough current to keep its resistance low, so that the FM signal incoming from C101 is not attenuated to arrive L101 at via C102.

■ FM IF CIRCUIT

FM IF section consists of 1 IC (integrated circuit), 1 transistor and 2 ceramic filters. Transistor Q103 is FM IF amplification transistor, which is to amplify IF signal which has been converted into 10.7 MHz signal at FM front end section. This 10.7 MHz IF signal is given a higher selectivity since it runs through the concentrated selective elements, that is, ceramic filters CF100 and CF101. These filters function to amplify IF (intermediate frequency) signals giving no distortion and to assure a necessary selectivity. The IF signal is further supplied to the terminal ① of IC100, in which the gain of this signal is increased by about 66 dB by the three-stage differential amplifier thus being subjected to an appropriate limiter function.

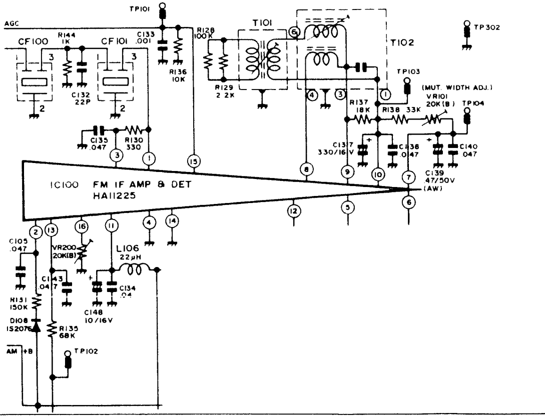
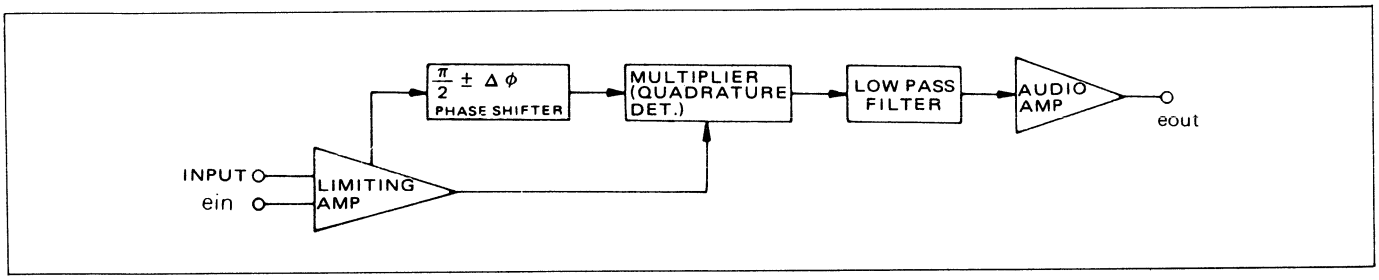

TP101
AGC
CF100
R144 1K
CF101
C133 .001
R128 100K
T101
T102
TP302
TP103
R136 10K
C132 22P
R129 2.2K
R137 18K
R138 33K
(MUT. WIDTH ADJ.) VR101 20K(B)
TP104
C135 .047
R130 330
C137 330/16V
C136 0.047
C140 .047
C139 47/50V (AW)
IC100 FM IF AMP & DET HA11225
C105 .047
VR200 20K(B)
L106 22μH
C143 .047
C134 .04
R131 150K
C148 10/16V
D108 1S2076
R135 68K
AM +B
TP102

Figure 9–2

■ FM DETECTION CIRCUIT (Quadrature Detector Circuit)

FM Detector Circuit

This unit employs 'Quadrature Detector' based on newly developed IC (Integrated Circuit), which is substituted for ratio detector and Foster-Seeley's detector that have been so far used. The basic structure of quadrature detector circuit is as shown in Figure 10–1.



$\frac{\pi}{2} \pm \Delta\phi$
PHASE SHIFTER
MULTIPLIER (QUADRATURE DET.)
LOW PASS FILTER
AUDIO AMP
eout
INPUT
ein
LIMITING AMP

Figure 10–1

With this detection system, the multiplier (quadrature detector) circuit receives two types of input signals, one is the signal which has been amplified by the limiting amplifier and another which has passed through the phase shift circuit (about $\pi/2$). Thus, the quadrature detector circuit produces demodulation signal.

The term 'quadrature' is resulted from that the phase difference between these two signal is $\pi/2$. The multiplier consists of doubly balance circuit as shown in the following circuit drawing. Phase characteristic of the phase shift circuit is as shown in Figure 10–3.

This circuit is featured by

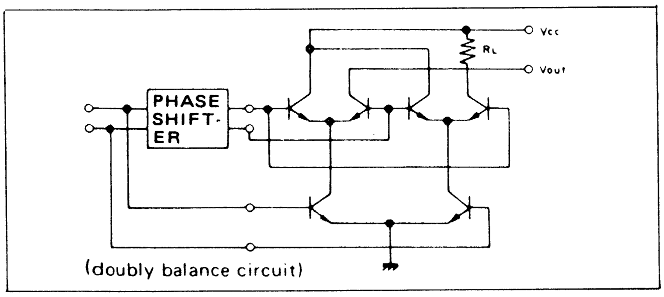
(1) Good linearity and low distortion.

(2) Operates on small signal and less higher harmonics.

(3) Wide-band detection of as much as 1.0MHz.

Therefore, this circuit assures low distortion even with the overmodulation of more than 100% thereby reproducing high quality sound.

T101 and T102 are 10.7MHz tuning quardrature coil. Detection output appears at the terminal ⑥ of IC100 and it is supplied to the op AMP of IC300.



Vcc
RL
Vout
PHASE SHIFTER
(doubly balance circuit)

Figure 10–2

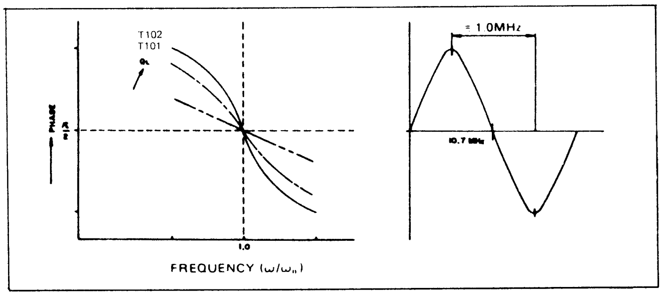
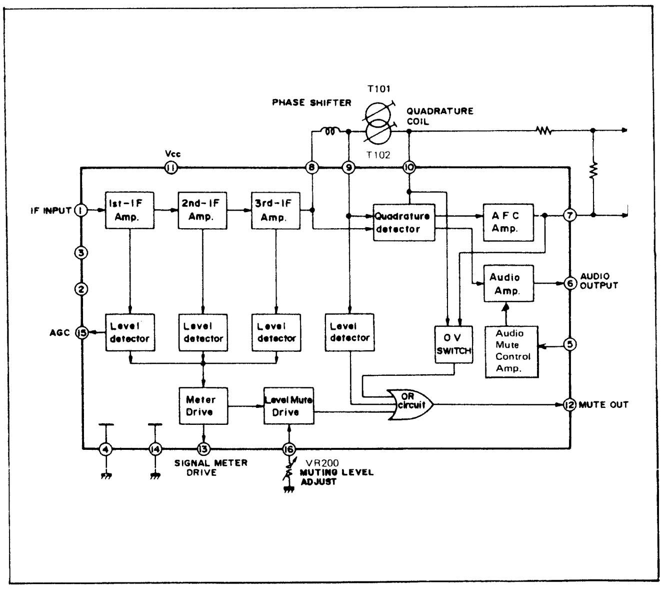


Figure 10–3

■ MUTING CIRCUIT

The muting signal ("High" level) from pin ⑥ of IC502 (synthesizer controller) is here applied, and activated just 0.5 to 1.0 ms before the data indicative of the band selection, memory selection, up/down counting and frequency scanning are transferred to the P.L.L. circuit and it remains activated until 500 ms after that data transfer operation has finished. The signal going out of pin ⑥ of IC502 passes through D507 and R620 to turn Q606 on, so that Q607 turns off with the voltage of its collector becoming "High" level. This voltage then is passed on via ZD300, R339 and R338 into Q302 and Q303 to turn them on. In this way, random noise possibly caused during the data transfer to the P.L.L. circuit can be muted.



T101
PHASE SHIFTER
QUADRATURE COIL
T102
Vcc
⑪
⑧
⑨
⑩
IF INPUT ①
Ist-IF Amp.
2nd-IF Amp.
3rd-IF Amp.
Quadrature detector
AFC Amp.
⑦
③
②
Audio Amp.
⑥ AUDIO OUTPUT
AGC ⑮
Level detector
Level detector
Level detector
Level detector
OV SWITCH
Audio Mute Control Amp.
⑤
Meter Drive
Level Mute Drive
OR circuit
⑫ MUTE OUT
④
⑭
⑬
⑯
SIGNAL METER DRIVE
VR200
MUTING LEVEL ADJUST

Figure 10–4

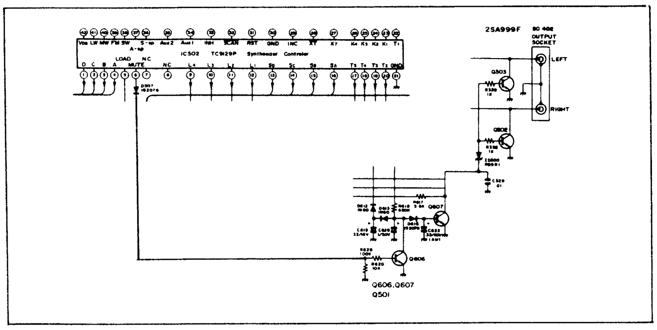

2SA999F
OUTPUT SOCKET
LEFT
RIGHT
IC502 TC9129P Synthesizer Controller
LOAD NC
MUTE
Q503
Q606,Q607
Q501

Figure 11–1

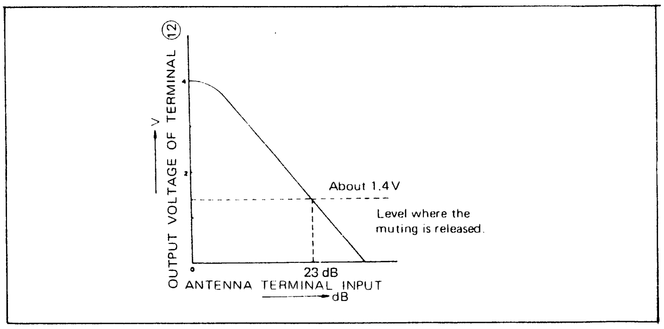


Figure 11–2 (IC 100)

■ LOW-PASS FILTER

FL300 and FL301 are low-pass filters to remove carrier signals (19 kHz, 38 kHz) leaking from the P.L.L. stereo multiplex demodulator IC101.
The characteristic is as shown in the figure 11–3.

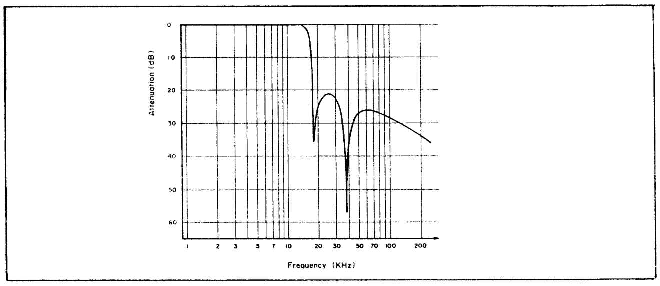


Figure 11–3

■ ACTIVE LOW-PASS FILTER

A low-pass filter is attached to the P.L.L. synthesizer circuit, and its function is to convert the digital output from the phase comparator into an analog one. The voltage obtained in this way is used to control the oscillation of V.C.O. frequency.
This type of filter is called an active low-pass filter because its high input impedance is provided by Darlington connection between an FET (field effect transistor) and an NPN transistor.

Note:
In the case of this IC type TC9125P, the output from the phase comparator is available at two terminals Do - 1 and Do - 2. Either one will do for this purpose.

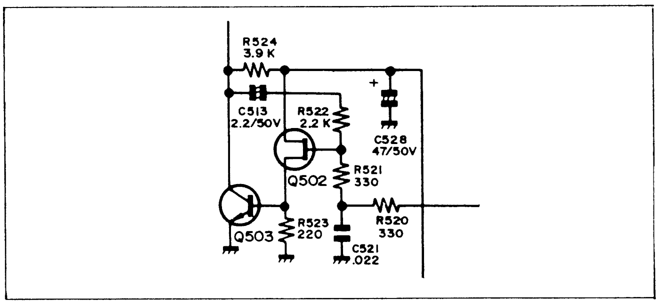

R524
3.9 K
+
C513
2.2/50V
R522
2.2 K
C528
47/50V
R521
330
Q502
Q503
R523
220
R520
330
C521
.022

Figure 11–4

■ P.L.L. MULTIPLEX STEREO DEMODULATOR

1. Merits of the P.L.L. multiplex stereo demodulator circuit
   (1) An automatic operation takes place so that the pilot signal and the 38 kHz signal are rept the in same phase relation, which limits the deterioraition of separation effect to minimum.
   (2) Since only one semi-variable resistor used here can take the place of 2 to 3 pieces of conventional coils, the possibility of the parts becoming faulty due to ageing is much decreased. Besides, if this semi-variable resisttor is slightly mis-adjusted enough to affect the separation effect, this is overcome by the merit mentioned in (1) by which the automatic phase adjustment is assured.
   (3) Compared with the conventional type, the P.L.L. system demodulator is more resistant to external noises since it has the characteristics of frequency selectivity and continuity (by a short-time memory) of the oscillation frequency. Thus a stabilized stereo demodulation is ensured.
2. FM stereo demodulator circuit of ST-5200H/HB IC101 is an integrated circuit to perform P.L.L. stereo demodulation.

V.C.O. (voltage-controlled oscillator) frequency is adjustable to 76 kHz by adjusting the semi-variable resistor VR300 (5k ohms): TP301 is a test point where this frequency can be measured.
During AM reception, +B voltage is supplied to IC101 via D302 and R331 to stop the oscillation fo V.C.O.

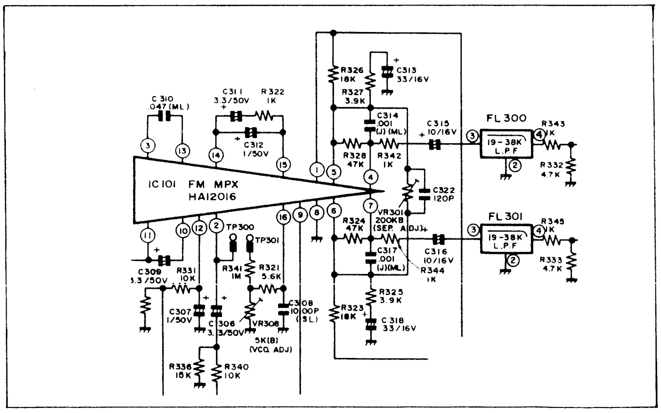

R326
18K
C313
33/16V
R327
3.9K
C310
.047(ML)
C311
3.3/50V
R322
1K
C314
.001
(J)(ML)
C315
10/16V
FL300
19-38K
L.P.F
R343
4.7K
R332
4.7K
C312
1/50V
R328
47K
R342
1K
IC101 FM MPX
HA12016
C322
120P
VR301
200KB
(SEP. ADJ)
R324
47K
FL301
19-38K
L.P.F
R345
4.7K
R333
4.7K
TP300
TP301
C317
.001
(J)(ML)
C316
10/16V
R344
1K
C309
3.3/50V
R331
10K
R341
1M
R321
5.6K
C307
1/50V
C306
3.3/50V
C308
100P
(SL)
VR300
5K(B)
(VCO ADJ)
R325
3.9K
R323
18K
C318
33/16V
R336
10K
R340
10K

Figure 11–5

■ AIR CHECK CALIBRATOR CIRCUIT

This circuit is used to allow FM broadcast, at the correct level, to be recorded on the tape deck or other audio systems. In Fig. 13–1, there is an oscillation circuit (composed of a C/R network) between pins ⑤ and ⑦ of IC300, which oscillates at 400 Hz to initiate the air check calibrator. When the air check switch (SW801) on the front panel is switched on, the voltage at pin ⑫ of IC400 rises to "High" level to turn on Q300. The output from pin ⑦ of IC300 then passes through C304, R319, C323, R352 and C302 during which its output phase is advanced by +180° from what it was before and it turns back to the negative terminal (pin ⑥) of IC300, which results in a positive feedback operation to allow the oscillation circuit to start oscillating.

ZD301 is given a voltage one half of that supplied to IC300 itself, and its output is delivered to pin ⑤ of IC300 to stabilize its operation.

Upon tuning in FM broadcast, 60% of the output signal (400 Hz) from the oscillator circuit is branched to enter the output terminal on the back panel, and with this it is possible to adjust the level of the air check signal by using the semi-variable resistor VR302.

■ MW/LW TUNER CIRCUIT

The MW/LW tuner circuit of this set is an electronic tuner using variable capacitance diodes in place of variable capacitors, and the MW/LW tuning is controlled only by the voltage coming via the variable capacitance diodes from the collector of transistor Q503 included in the P.L.L. synthesizer.

Whether the set gets in MW or LW mode depends upon the signals from pin ㊵ (MW) and pin ㊶ (LW) of IC502 (synthesizer controller) which turns on and off Q200 and Q201. To be more precise, the Q200 is off and Q201 is on in MW mode, and voltages of –6 V and +5 V are applied respectively to the collectors of the Q200 and Q201 so that D203, D204, D205, D206, D209 and D210 turn on to result in putting the antenna circuit and local oscillator circuit in MW mode. The MW signal picked up by the ferrite bar antenna LA200 is applied to the tuner circuit which consists of D201, TC200 and C204, and, going out of the secondary winding of LA200, it is fed via C220 to pin ② of IC200 where its RF component is amplified. Then it enters the IF cut-off circuit which consists of L205 and C218 between pin ④ and pin ⑦ and, here, its IF component is removed, then it goes out pin ⑦ to arrive at the IF converter.

The IF signal caused at pin ⑤ then passes through the local oscillator coil (L201) to enter pin ⑧ of IC200 (IF amplifier) via T200 (IFT) and CF200 (ceramic filter). Then, the signal goes out of pin ⑨ of IC200 to arrive at pin ⑬ via C223, L206, and R211 going out of pin ⑫ , and it is applied via R214 and C229 to pin ⑩ of IC300 (operational amplifier).

In LW mode, on the other hand, the Q200 is on and the Q201 is off so that voltages of +5 V and –6 V are applied respectively to the collectors of the Q200 and Q201; therefore, D207, D208, D211 and D212 turn on to get the antenna circuit and local oscillator circuit in LW mode.

The LW signal picked up by the ferrite bar antenna LA200 is delivered to the tuner circuit which consists of D202, TC201, C203, and, going out of the secondary winding of LA200, it arrives at pin ② of IC200 via C220.

The local oscillator circuit is composed of L200, TC203, C213 and C239, and D200.

From pin ⑮ of the IC200 applied is the signal meter drive output thru R215 to IC300 (P.L.L. synthesizer), while the AM auto stop signal is applied together with the IF signal thru L206 and C232 to Q203 to be amplified there, subjected to full-wave rectification at diodes D214 and D215, then amplified by the IC300 (operational amplifier), and finally passed on to the IC502 (synthesizer controller).

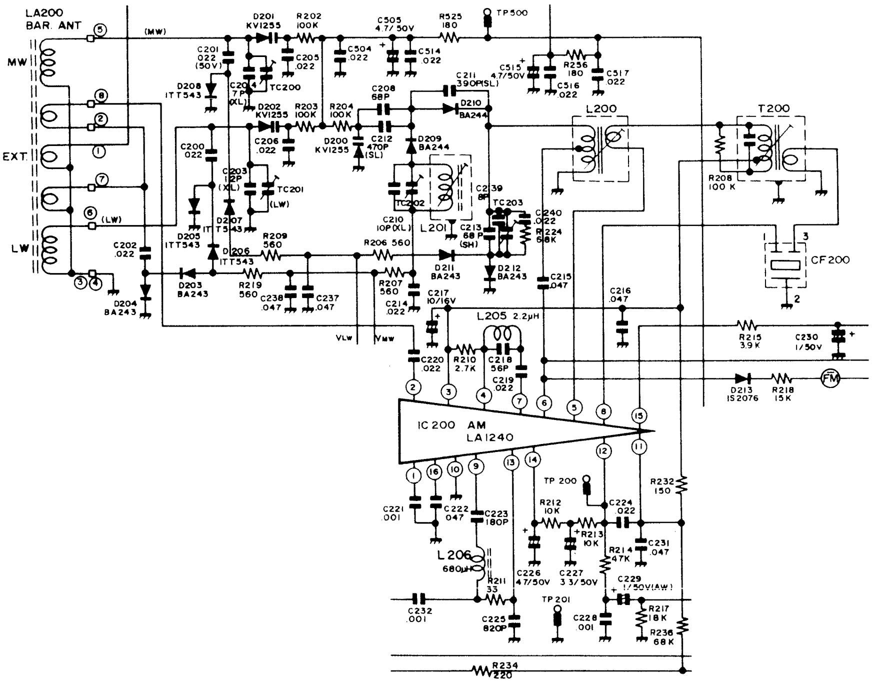

LA200
BAR ANT
MW
EXT
LW
(MW)
(LW)
D201 KV1255
R202 100K
C505 4.7/50V
R525 180
TP500
C201 .022 (50V)
C205 .022
C504 .022
C514 .022
C511 4.7/50V
R236 180
C517 .022
C211 390P(SL)
C516 .022
D208 ITT543
C204 7P (XL)
TC200
C208 68P
D210 BA244
L200
T200
D202 KV1255
R203 100K
R204 100K
C200 .022
C206 .022
D200 KV1255
C212 470P (SL)
D209 BA244
R208 100K
C203 12P (XL)
TC201 (LW)
TC202
C239 8P
TC203
C210 10P(XL)
L201
C213 68P (SH)
C240 .022
R224 68K
CF200
C202 .022
D205 ITT543
D207 ITT543
R209 560
D206 ITT543
R206 560
D211 BA243
D212 BA243
C215 .047
D203 BA243
R219 560
C238 .047
C237 .047
R207 560
C217 10/16V
C214 .022
C216 .047
D204 BA243
L205 2.2μH
VLW
VMW
R215 3.9K
C230 1/50V
C220 .022
R210 2.7K
C218 56P
C219 .022
D213 1S2076
R218 15K
FM
IC200 AM LA1240
TP200
R232 150
C221 .001
C222 .047
C223 180P
R212 10K
C224 .022
R213 10K
C231 .047
L206 680μH
R214 47K
C226 47/50V
C227 3.3/50V
C229 1/50V(AW)
R211 33
TP201
R217 18K
C232 .001
C225 82P
C228 .001
R236 68K
R234 220

Figure 12

■ AIR CHECK ON/OFF CIRCUIT

When the power switch is turned on, Q400 immediately turns on to make pin ② of IC400 be grounded.
In FM reception, when the air check switch (SW801) is turned on, pin ① of IC400 becomes "Low" level so that the output of IC400 becomes opposite in polarity to what it was before. Then pin ⑬ of IC400 changes from "High" to "Low" level to turn off Q801. With Q801 turned off, a voltage is caused to enter the air check LED(801) to light it up.
Meanwhile, pin ⑫ of IC400 changes from "Low" to "High" level, and the voltage is applied via R320 to the base of Q300 to turn it on. Q300 which has turned on allows the air check circuit to start oscillating.

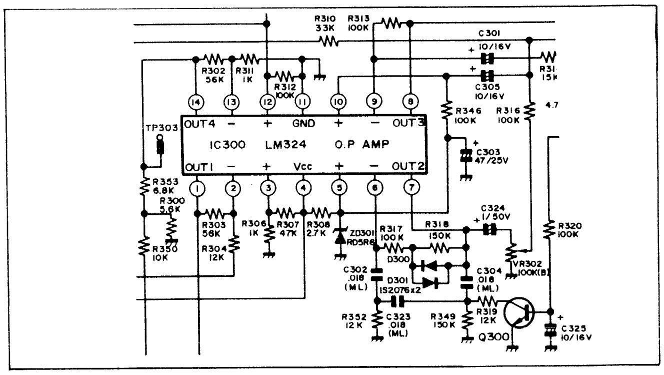

R310
33K
R313
100K
C301
10/16V
R302
56K
R311
1K
R312
100K
R31
15K
C305
10/16V
R346
100K
R316
100K
4.7
TP303
OUT4
−
+
GND
+
−
OUT3
IC300
LM324
O.P AMP
OUT1
−
+
Vcc
+
−
OUT2
C303
47/25V
R353
6.8K
R300
5.6K
R350
10K
R303
56K
R304
12K
R306
1K
R307
47K
R308
2.7K
ZD301
RD5R6
R317
100K
R318
150K
C324
1/50V
R320
100K
D300
C302
.018
(ML)
D301
1S2076x2
C304
.018
(ML)
VR302
100K(B)
R352
12K
C323
.018
(ML)
R349
150K
R319
12K
Q300
C325
10/16V

Figure 13–1

■ SELECTOR CIRCUIT

The selector circuit is made of IC400, which works as a flip-flop circuit and whose truth table is as shown in Fig. 13–2.

⎍ : A state of "High" level
H : "High" level
L : "Low" level
X : Either "High" or "Low" level will do.

Input				Out put	
CLEAR	CLOCK	J	K	Q	$\overline{Q}$
L	X	X	X	L	H
H	⎍	H	H	TOGGLE	

Figure 13–2

■ STEREO/MONO SELECTOR CIRCUIT

Pulse T_2 from pin ⑳ of IC502 (synthesizer controller) is applied to pin ③ of IC700 (7-segment inverting buffer), and it goes out of pin ⑭ of IC700 to be fed as a clock signal to pin ⑤ of IC400 (dual J–K flip flop).
The moment the power switch is switched on, Q406 turns on and pin ⑥ of IC400 becomes "Low" level so that pins ⑧ (2$\overline{Q}$) and ⑨ (2Q) become "High" and "Low" level respectively. Then Q407 turns off and Q408 turns on to let the "2$\overline{Q}$" and "2Q" be at "High" and "Low" level respectively through R417 and R415, and so Q803 turns on and Q804 turns off to light up LED802 (FM stereo indicator LED) by the constant current Io.
Now that pin ⑨ (2Q) of IC400 is at "Low" level, no voltage is applied through D303 and R331 to pin ⑫ of IC101 (multiplex stereo demodulator) so that the IC101 causes the set to operate in stereo mode but not in mono mode. The set accordingly functions always in stereo mode when the power switch is turned on.
When the FM mono switch SW804 is pushed on, pulse T_1 from pin ㉒ of IC502 is applied to R401 via D706: it is subjected to ripple rectification by this R401 and C400. By this voltage, Q401 turns on and Q402 turns off so that pin ⑦ (2J) of IC400 becomes "High" level. At this time, the output from pin ⑧ (2$\overline{Q}$) is changed from "High" to "Low" leve and that from pin ⑨ (2Q) is changed from "Low" to "High" level. Then, Q407 turns on and Q408 turns off so that Q804 turns on and Q803 turns off to light LED803 (FM mono indicator LED) up. The "High" level signal from pin ⑨ (2Q), on the other hand, applies a voltage of about 3 V to pin ⑫ of IC101 via D303 and R331 so that the IC101 causes the set to operate in FM mono mode instead of FM stereo mode.
When the FM stereo switch SW805 is pushed on, the pulse T_1 passes through R408 to turn on Q405 and turn off Q404 so that pin ⑩ (2K) of IC400 becomes "High" level. This results in that pin ⑧ (2Q) is changed from "Low" to "High" level, and pin ⑨ (2Q) is changed from "High" to "Low" level, and so the IC101 causes the set to operate in stereo mode.

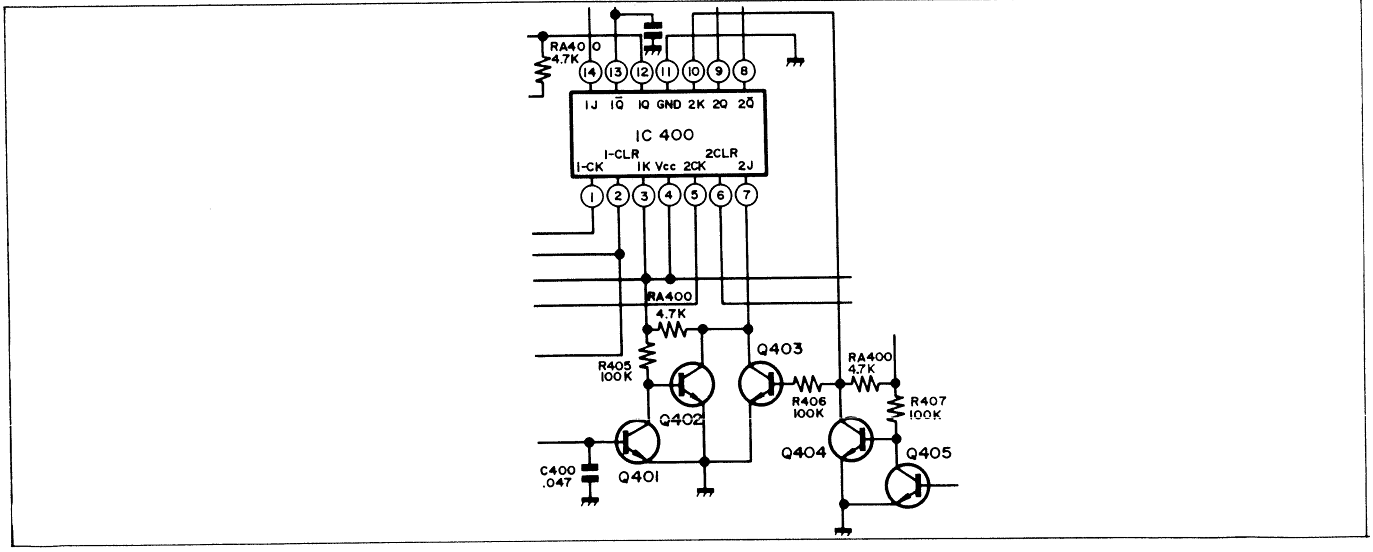

RA400
4.7K
⑭⑬⑫⑪⑩⑨⑧
1J 1Q̄ 1Q GND 2K 2Q 2Q̄
IC 400
1-CLR
2CLR
1-CK
1K Vcc 2CK
2J
①②③④⑤⑥⑦
RA400
4.7K
R405
100K
Q402
Q403
RA400
4.7K
R406
100K
R407
100K
Q404
Q405
C400
.047
Q401

Figure 13–3

■ HIGH BLEND CIRCUIT

As far as the high blend switch SW800 is not operated, pin ① of IC401 (dual J–K flip flop) is kept at "High" level since it is then connected with the +B (5 V) line through R412. And the moment the power switch is switched on, pin ② of IC401 becomes "Low" level so that its outputs from pin ⑫ (3Q) and from pin ⑬ (3$\overline{Q}$) get "Low" and "High" level respectively.

However, when the high blend switch SW800 is pushed on, pin ① of IC401 falls to "Low" level so that its output from pin ⑫ (3Q) is changed from "Low" to "High" level and its output from pin ⑬ (3$\overline{Q}$) is changed from "High" to "Low" level.

With the output from pin ⑬ (3$\overline{Q}$) of IC401 at "Low" level, Q305 turns on to apply +B voltage to the cathode of D305 via D304 so that the gate of Q304 (FET) is floated by the reverse voltage of this D305, and the gate voltage accordingly becomes higher than the source voltage to turn on the Q304 (FET). Therefore, the output signals from the right and left channels are mixed together across R343 and C320, and at the time the noise components in both channels are cancelled out to result in a high blend effect of the two signals.

When the high blend switch SW800 is pressed again, pin ⑫ (3Q) of IC401 is changed from "High" to "Low" level and pin ⑬ (3$\overline{Q}$) is changed from "Low" to "High" level.

With pin ⑬ (3$\overline{Q}$) at "High" level, Q305 turns off and a voltage of –6 V is induced at the cathode of D305, so that the gate voltage of Q304 (FET) becomes minus; and since the Q304 is then off, the C320 cuts off the right and left channels from each other so that there is no longer the mixing of the signals from both channels.

As for LED800 (high blend indicator LED), it lights up when it receives a constant current (Io) through Q504 or Q805, the current which is caused in "High blend on" mode where pin ⑫ (3Q) of IC401 becomes "Low" level to turn off Q800. In "High blend off" mode, the LED 800 does not light up because the Q800 is turned on and the constant current (Io) is thereby bypassed to the Q800.

■ LED INDICATOR

LED700 ~ LED709 and LED711 are connected with the matrix circuit composed of inverting and non-inverting buffers, which comprises pins ㉒ down to ⑰ (representative of T_1, T_2, T_3, T_4 and T_5 signals) and pins ⑫ down to ⑨ (representative of L_1, L_2, L_3 and L_4 signals), all pins belonging to IC502. T_1 ~ T_5 are the pulses wihch are scanned in succession at a frequency of 330 Hz, and L_1 ~ L_4 are the timing pulses: an LED lights up when T pulse and L pulse go together on the same timing. Let's take an example of how the LED 711 lights up, which is connected with pin ⑳ (T_2) of IC502 and pin ⑩ (L_3) of IC502: the former pin ⑳ is further connected with pin ③ of IC700. When the T_2 becomes "High" level, the IC700 works as a inversion buffer to cause the cathode of LED711 to be in "Low" level. And when the L_3 becomes "High" level, Q701 turns on and +B power (5 V) at its collector enters the anode of LED711 via R701. As the cathode of LED711 has been in "Low" level, there is now a current caused to run into the LED711 to light it up.

■ SIGNAL INDICATOR CIRCUIT

1. During FM reception:

   A voltage proportional to the FM signal strength received is caused to enter pin ⑬ of IC100 (FM IF amplifier) and it arrives via R135 and R303 at pin ② of IC300 (operational amplifier): to pin ③ of IC300 is applied 0.3 V (reference voltage) at the same time.

   The output from the operational amplifier now goes out of pin ① of IC300, and it, which is inversely proportional to the voltage at pin ② , is applied to pin ⑧ of IC503 (signal LED driver). And as the output voltage from pin ① of IC300 lowers more, LEDs of the LED array (LA700) light up in succession. The LEDs are connected in series with each other and they are connected with the constant current circuit consisting of Q505, R512, R511 and R513, which is designed to make its current constant at 15 mA regardless of the number of LEDs in action.

2. During AM reception:

   The voltage which appears at pin ⑮ of IC200 is applied to pin ② of IC300 via R215 and R304, through which it is amplified by the operational amplifier (inside IC300) to go out of pin ① : this output is inversely proportional to the output at pin ② . It then enters pin ⑧ of IC503, and as the output voltage from pin ① of IC300 lowers more, LEDs of the LED array (LA700) light up in succession.

■ FREQUENCY INDICATOR CIRCUIT

(a) Pulses for the anodes of the display tube:

There are pulses produced at pins ⑬ ~ ⑯ of IC502 (synthesizer controller), and they are each representative of the information data of what frequency the set is now receiving and emitted in BCD (binary coded decimal) four digits in serial form to keep in time with the timing signals T_1 ~ T_5 which are also generated.

These BCD signals then enter pins ③ ~ ⑥ of IC702, and here they are converted to become signals to drive the seven segments of the display tube.

The signals to drive the seven segments are referred to as "a" ~ "g", and they are applied to the respective pins connected to the anodes of the fluorescence display tube, as follows:

"a" to pin ㉗ , "b" to pin ⑩ , "c" to pin ⑫ , "d" to pin ⑮ , "e" to pin ⑬ , "f" to pin ㉓ , "g" to pin ㉑ .

(b) Pulses for the grids of the fluorescence display tube:

There are pulses produced at pins ⑰ ~ ㉒ of IC502 (synthesizer controller), and they are scanned at a frequency of 330 Hz and emitted to keep in time with the timing pulses T_1 ~ T_5 which are then produced.

These timing-controlled signals then arrive at pins ① ~ ⑤ of IC701. The IC701 consists of seven independent buffers of non-inverting type, and its output is protected against as much as 50 V since it has an open drain structure aided by P-channel MOS FET's included in it.

Then the signals go out of pins ⑪ ~ ⑮ of IC701 to drive the grids of the fluorescence display tube.

■ BAND INDICATOR CIRCUIT

(a) For FM reception:
The grids of the fluorescence display tube which indicate FM band reception, the decimal point and frequency unit (MHz) are all connected to pin ⑮ (representative of T_1 signal) of IC701: and the corresponding anodes are connected to pin ⑪ (representative of L_2 signal) of IC502 via the buffer of IC701. The T_1 and L_2 signals are timed so as to light the segments indicating the FM band, the decimal point and the frequency unit (MHz), when the set is receiving FM frequency.

(b) For AM reception: (MW/LW)
The grids of the fluorescence display tube which indicate AM band reception and frequency unit (kHz) are each connected with pin ⑮ (representative of T_1 signal) of IC701: and the corresponding anodes are connected to pin ⑨, ⑩ (representative of L_4, L_3 signal) of IC502 via the buffer of IC701. The T_1 and L_4, L_3 signals are timed so as to light the segments indicating the AM band and frequency unit (kHz) when the set is receiving AM frequency.

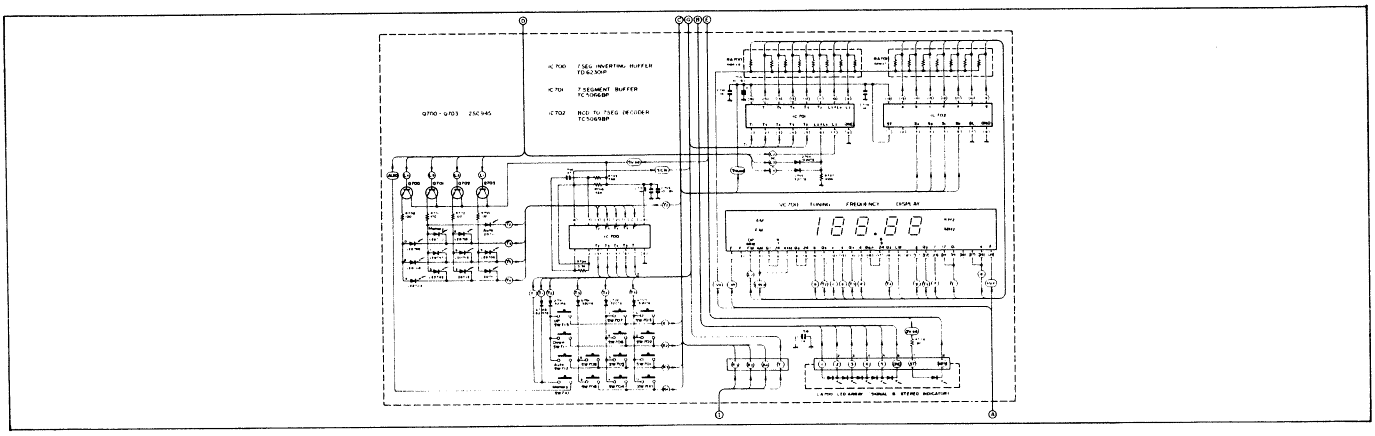


Figure 15–1

■ DISPLAY CIRCUIT

The fluorescence display tube used in the ST-5200H/HB is of the dynamic drive type as shown in Fig. 15–2 in which the anodes (segments) are connected in series with each other. Fig. 15–2 also shows what voltage is required to activate each segment and that the fluorescence display tube is allowed to light only when the grid and the anode are positive with respect to the filament.

The pulses from the grids, i.e., the digit signals, are scanned at a frequency of 330 Hz, and they are applied to the segments to light them up: in Fig.15–3 is shown the timing chart for the grid signals and the segment signals.

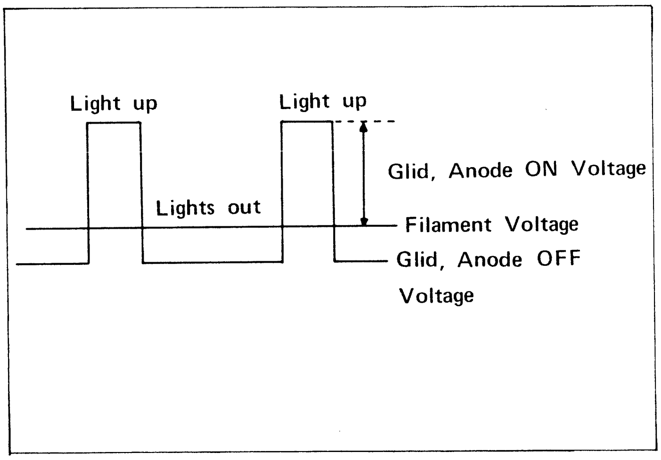
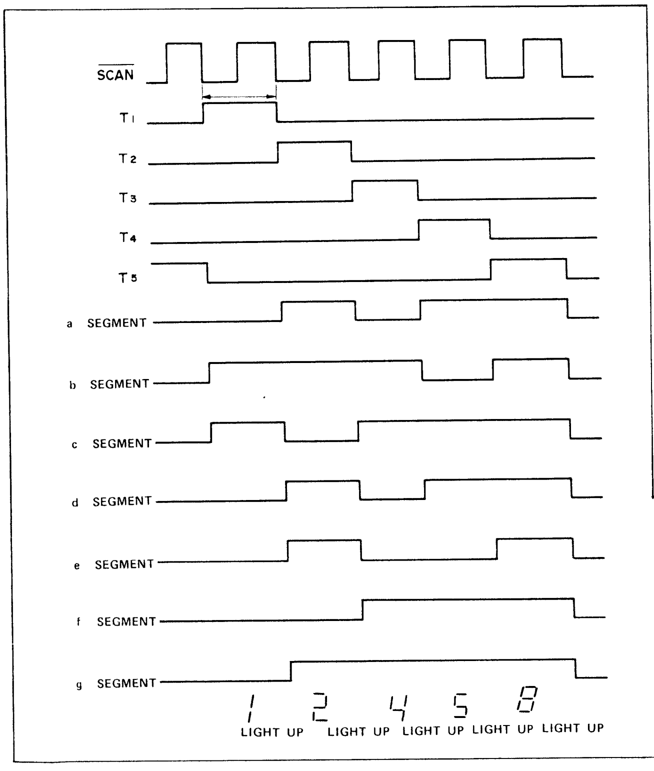


Figure 15–2



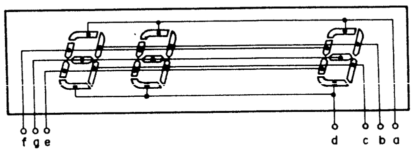


Figure 15–3

■ POWER SUPPLY CIRCUIT

The ST-5200H/HB has its primary functions controlled by the built-in microprocessor, the memories of which are made activated according to the voltage timings caused by switching on and off the power switch. Fig. 17 is the timing chart in which the terms "sd" and "usd" are referred to as:

- "sd" (switched); the voltage caused by the power switch in operation
- "usd" (unswitched); the voltage present irrespective of the power switch

1. When the power swtich is turned on:

   In this case there are three different "sd" voltages, 27V, 12 V and 5 V.

   C624 is already charged if the AC power supply cord has been connected to a wall outlet (provided that a power interruption does not occur). The if the power switch (SW600) is turned on, Q608 turns on immediately and Q609 also turns on to produce 27 V.

   With Q609 turned on, the voltage at its collector is fed to the base of Q602 via R608 and D615 so that Q602 turns on and there appears 12 V at its emitter, which is available from the charged C606.

   These 27 V and 12 V supplies are produced almost simultaneously when the power switch is turned on, the timing of which is as shown in the timing chart.

   In addition, the turning on of Q609 causes Q605 and Q604 to become active to create 5 V and 7 V, respectively. ZD602 produces about 5.6 V, and it is used as the reference voltage from which the output (5 V) from the emitter of Q605 results.

2. When the power switch is turned off:

   That is, this 5 V is always available througth R600 and R610 from the charged C606 even if the power switch is turned off.

   ZD600 produce about 5.6 V, and it is used as the reference voltage from which the 5 V line is produced. This 5 V is used to activate alive the microprocessor whether the power switch is turned on or off.

3. When a power failure occurs with the power swtich turned on:

   Even in this case, the said "usd" voltage (5 V) remains alive as before.

   At this moment, however, the charged C624 starts to discharge through R628, and Q608 turns off immediately. Q609, Q602, Q605 and Q604 accordingly turn off causing 27 V, 12 V and 5 V (all "sd") to cease, and the display tube extinguishes the moment the power fails.

   The power failure causes the voltage at the base of Q603 to be grounded through R605, D610 and R621, so that Q603, despite the power failure, continues to be on and its collector receives 6 V from the battery. This voltage is referred to as the back-up voltage to be used in an emergency, which is delivered to the microcomputer to energize it during a power failure.

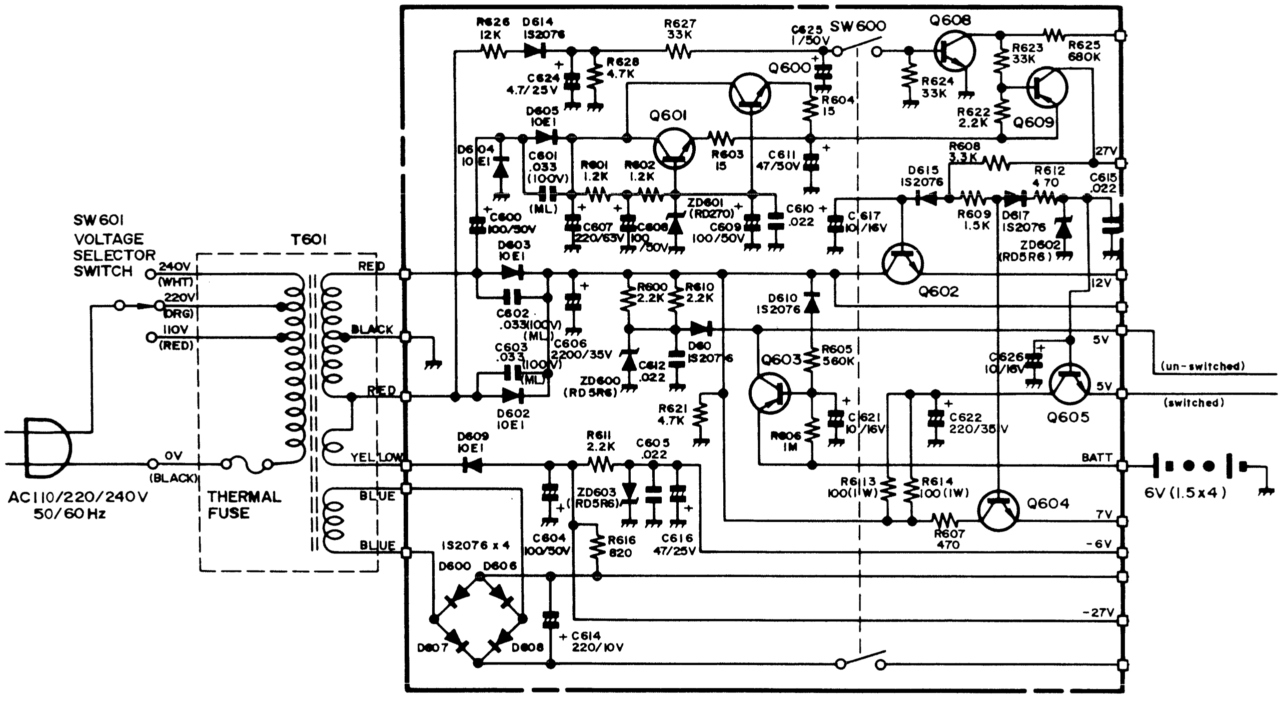
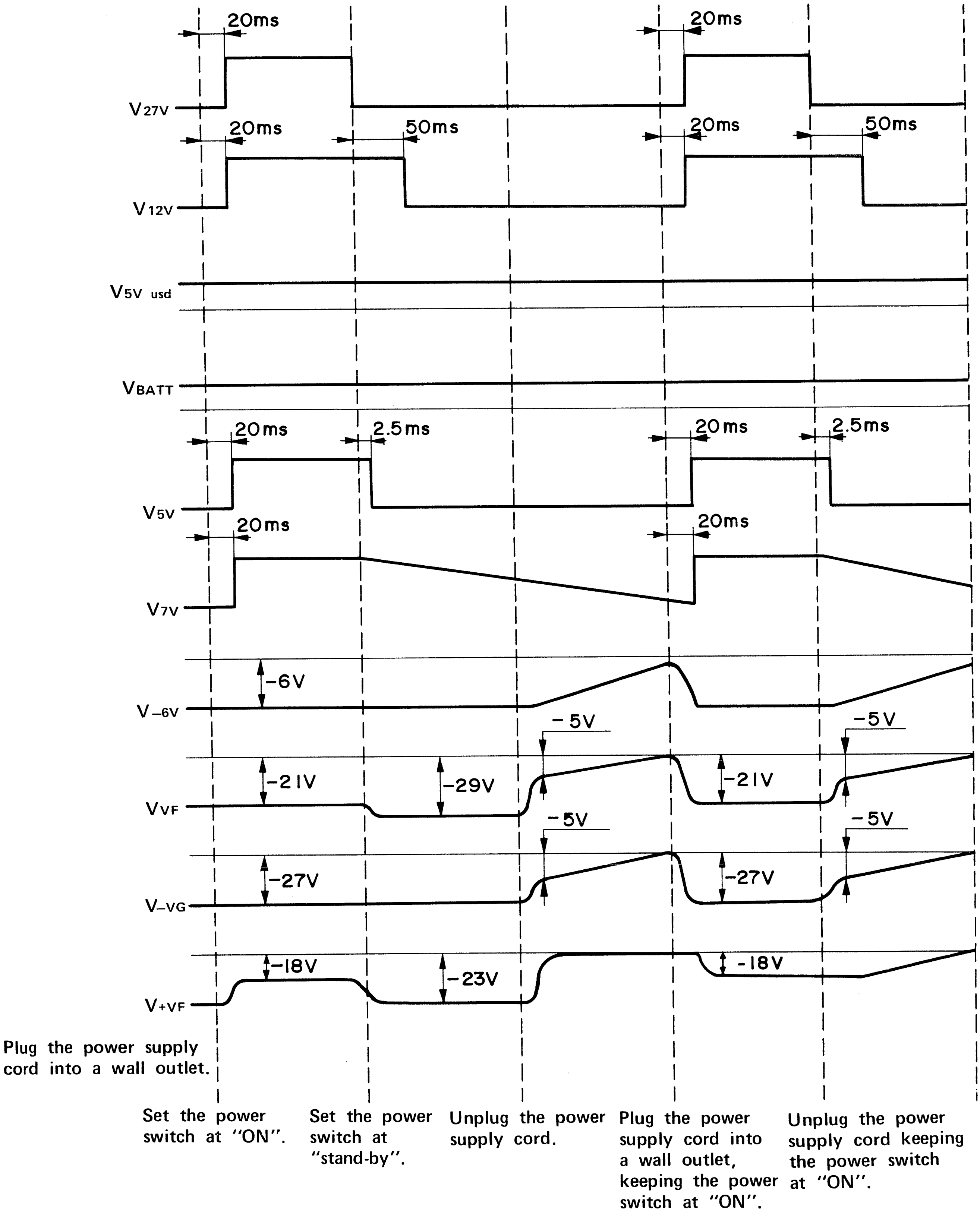

SW601
VOLTAGE
SELECTOR
SWITCH
240V
(WHT)
220V
(ORG)
110V
(RED)
0V
(BLACK)
AC110/220/240V
50/60Hz
THERMAL
FUSE
T601
RED
BLACK
RED
YELLOW
BLUE
BLUE
R626
12K
D614
1S2076
C624
4.7/25V
R628
4.7K
R627
33K
C625
1/50V
SW600
Q600
R604
15
Q608
R624
33K
R623
33K
R625
680K
R622
2.2K
Q609
D605
10E1
Q601
D604
10E1
C601
.033
(100V)
(ML)
R601
1.2K
R602
1.2K
R603
15
C611
47/50V
C600
100/50V
C607
220/63V
C608
100
/50V
ZD601
(RD270)
C609
100/50V
C610
.022
C617
10/16V
R608
3.3K
D615
1S2076
R609
1.5K
D617
1S2076
R612
470
ZD602
(RD5R6)
C615
.022
27V
D603
10E1
C602
.033(100V)
(ML)
C603
.033
(100V)
(ML)
C606
2200/35V
R600
2.2K
R610
2.2K
ZD600
(RD5R6)
C612
.022
D610
1S2076
Q602
12V
Q603
R605
560K
R606
1M
C621
10/16V
R621
4.7K
C626
10/16V
5V
(un-switched)
5V
(switched)
Q605
C622
220/35V
D602
10E1
D609
10E1
R611
2.2K
C605
.022
ZD603
(RD5R6)
C604
100/50V
R616
820
C616
47/25V
R613
100(1W)
R614
100(1W)
R607
470
Q604
BATT
6V (1.5x4)
7V
-6V
-27V
1S2076 x 4
D600
D606
D607
D608
C614
220/10V

Figure 16



NOTES:

1) The time constant in this figure is expressed as center value.
2) "20 ms" shows the time in which the voltage rises up – the rising must end; within this period.
3) This figure is confined to the description of the voltage rise/fall timings only.
4) ms: milliseconds

Figure 17 Power Supply Circuit Timing Chart

■ P.L.L. SYNTHESIZER

This section basically consists of synthesizer controller (IC502), PLL synthesizer (IC501), prescaler (IC500) and low-pass filter as indicated in the schematic shown in Fig. 22–1. Circuit block diagram of each IC is shown in Fig. 22–2. Fig. 23–1 ~ 23–2.

We here explain what pins each IC is provided with and what functions they have.

1) IC502 (synthesizer controller)

Pin ㉗ (X_T terminal)
Pin ㉘ ($\overline{X}_T$ terminal)

Connected with the oscillator which produces pulses T_1 ~ T_4 and A ~ D, all of sine wave oscillation at 200 kHz.

Pin ㉒ (T_1 terminal)
Pin ⑳ (T_2 terminal)
Pin ⑲ (T_3 terminal)
Pin ⑱ (T_4 terminal)
Pin ⑰ (T_5 terminal)

Pulses T_1 ~ T_5 are used to activate the display and make digit (matrix) selection according to the signals by input key operation. They are under control by the pulses applied to $\overline{\text{SCAN}}$ terminal.

Pin ⑯ (S_A terminal)
Pin ⑮ (S_B terminal)
Pin ⑭ (S_C terminal)
Pin ⑬ (S_D terminal)

BCD (binary coded decimal) data in 4 digits which are indicative of the received frequency are emitted from here in succession, keeping in time with the pulses T_1 ~ T_5.

Pin ⑫ (L_1 terminal)
Pin ⑪ (L_2 terminal)
Pin ⑩ (L_3 terminal)
Pin ⑨ (L_4 terminal)

The signals which drive the LED lamps are emitted from here, keeping in time with the pulses T_1 ~ T_5.

Pin ⑥ (Mute terminal)

The muting signal ("High" level) arises here and it continues for 500 ms, starting 0.5 to 1 ms before the P.L.L. circuit has started to receive the data indicative of the memory scan, band selection, memory recall and up/down scan. See Fig. 18–1.

This signal also arises when the set is in "Inhibit" mode and its duration is about 1 ms.

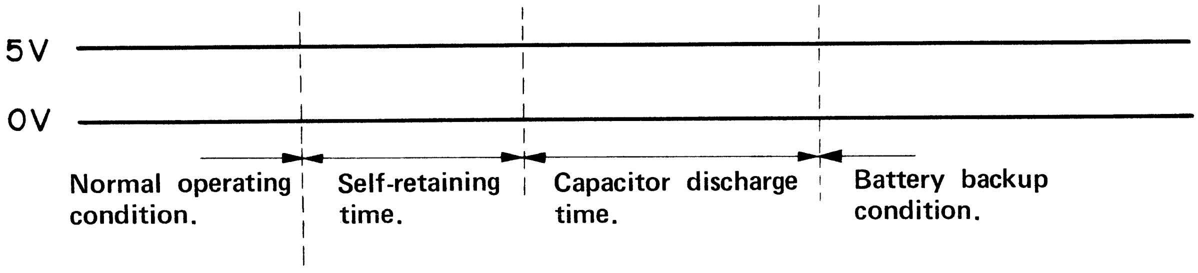

5V
0V
Normal operating condition.
Self-retaining time.
Capacitor discharge time.
Battery backup condition.

Figure 18–1

Pin ㉓ (K_1 terminal)
Pin ㉔ (K_2 terminal)
Pin ㉕ (K_3 terminal)
Pin ㉖ (K_4 terminal)

Data to indicate depression of the keys on keyboard are here applied keeping in time with pulses T_1 ~ T_5. Relation between K_1 ~ K_4 and T_1 ~ T_5 is as follows.

KEY	K_1 ~ K_5	T_1 ~ T_5
FM stereo	K_2	T_1
FM mono	K_2	T_1
MW	K_3	T_1
LW	K_4	T_1
0	K_4	T_5
1	K_3	T_5

KEY	K_1 ~ K_5	T_1 ~ T_5
2	K_2	T_5
3	K_1	T_5
4	K_4	T_4
5	K_3	T_4
6	K_2	T_4
7	K_1	T_4

KEY	K_1 ~ K_5	T_1 ~ T_5
8	K_4	T_3
9	K_3	T_3
UP	K_1	T_2
DOWN	K_2	T_2
Auto 1	K_3	T_2

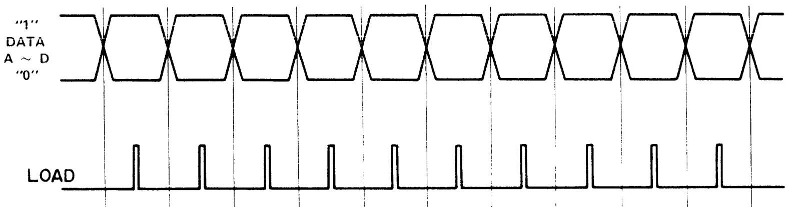
Figure 18–2

Pin ⑤ (LOAD terminal) Pulses are emitted from here to control the timing of data A ~ D as they are loaded in IC501 (PLL synthesizer). IC501 is allowed to read the data when this pin ⑤ is in "High" level.

Pin ④ (A terminal)
Pin ③ (B terminal)
Pin ② (C terminal)
Pin ① (D terminal)

Data emitted from here are to decide the reference frequency and frequency division of the programmable counter.

Fig. 19 shows in what timing the data go out of the LOAD, A ~ D terminals: the data output is in a format of binary code (4 bits).



		In the unit of ones Address designation	In the unit of ones Data Set	In the unit of tens Address designation	In the unit of tens Data Set	In the unit of hundreds Address designation	In the unit of hundreds Data Set	In the unit of thousands Address designation	In the unit of thousands Data Set	Mode Set Address designation	Mode Set Data Set
DATA	A	1	A_1	0	A_2	1	A_3	0	A_4	1	A_5
	B	1	B_1	0	B_2	0	B_3	1	B_4	1	B_5
	C	0	C_1	1	C_2	1	C_3	1	C_4	1	C_5
	D	1	D_1	1	D_2	1	D_3	1	D_4	1	0
		F=11	F=0~9	F=12	F=0~9	F=13	F=0~9	F=14	F=0~9	F=15	F=0~7

Figure 19

* Note that waveforms of the LOAD, A ~ D terminals can not be observed without a logic analyzer.

Pin ㊴ (FM terminal)
Pin ㊵ (MW terminal)
Pin ㊶ (LW terminal)

Data emitted from here is for selection of FM, MW or LW band, and it remains "High" level when the respective band is selected.

Pin ㉛ ($\overline{\text{RST}}$ terminal, logic "L")

When the AC power supply cord once unplugged is again plugged to the wall outlet without being supported by the battery power, the signal from this terminal brings the set to its initial state (to display the lowest FM frequency).

Pin ㉜ ($\overline{\text{SCAN}}$ terminal, logic "L")

The 330 Hz signal is here applied, and its falling edge is used to trigger all the timing signals and to decide the scanning speed.

Pin ㉞ (AUX 1 terminal)
Pin ㉟ (AUX 2 terminal)

The signals applied here are to indicate the user area and scan step, when the power switch is turned on. There are T_3 at the AUX 1 terminal and T_1 at the AUX 2 terminal.

Pin ㊱ (SCAN-SPEED terminal)

The signal applied here is to decide the scan speed.

Pin ㊲ (AUTO-STOP terminal)

The signal applied here is to stop the auto-scanning.

Pin ㉑ (GROUND terminal)
Pin ㉚ (GROUND terminal)
Pin ㊷ (V_{DD} terminal)

A power of 5 V is applied here always regardless of whether the power switch is at "on" or "off" position.

If, however, the AC power supply cord is unplugged or a power failure occurs, this supply of 5 V is cut off after the capacitor discharges, then the battery power will be supplied automatically.

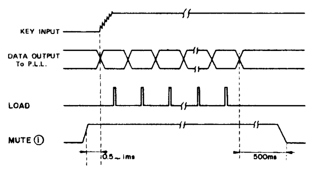

KEY INPUT
DATA OUTPUT To P.L.L.
LOAD
MUTE ①
0.5~1ms
500ms

Figure 20–1

The following shows waveforms of the signals present at the major terminals:

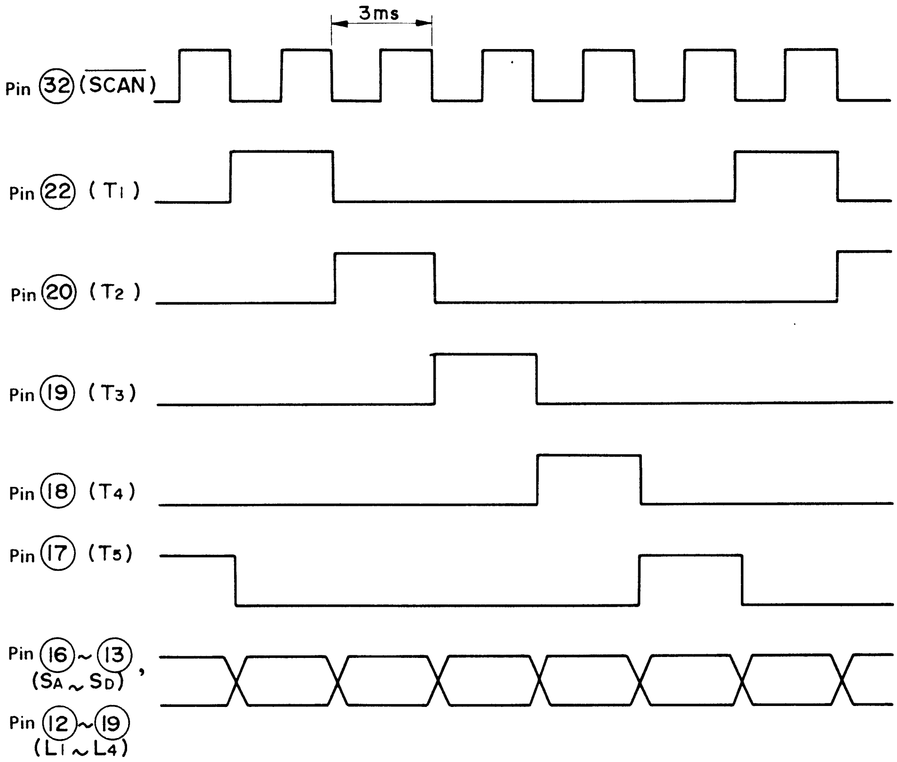

3ms
Pin ㉜ (SCAN)
Pin ㉒ (T1)
Pin ⑳ (T2)
Pin ⑲ (T3)
Pin ⑱ (T4)
Pin ⑰ (T5)
Pin ⑯~⑬, (SA~SD)
Pin ⑫~⑲ (L1~L4)

Figure 20–2

As for S_A ~ S_D and L_1 ~ L_4, each of them is killed for about 100μs before it experiences control by the timing pulse and also for 250μs (max.) after it is subject to that control. This is in order to prevent mutual interference between them.

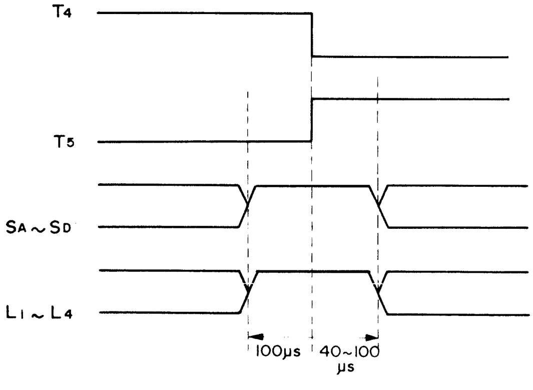

T4
T5
SA~SD
L1~L4
100μs
40~100 μs

Figure 20–3

2) IC501 (P.L.L. synthesizer)

Pin ② (X̄T terminal)
Pin ③ (XT terminal) } Connected with the crystal oscillator which oscillates at 9 MHz to produce signals of sine wave.

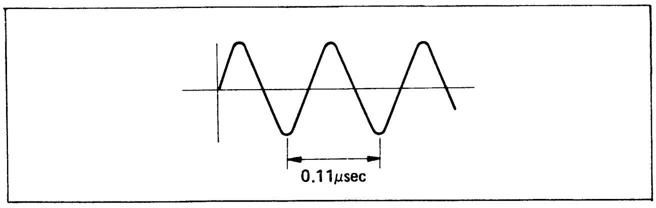


Figure 21–1

Pin ④ (LOAD terminal) The signals applied here are to make the A ~ D terminals read in their data. The data reading-in is allowed when this terminal is at "High" level, and at "Low" level the data remain as it was before.

Pin ⑤ (A terminal)
Pin ⑥ (B terminal)
Pin ⑦ (C termianl)
Pin ⑧ (D terminal)

The data applied here are to decide the reference frequency and frequency division of the programmable counter. terminals are provided with their respective program data.

Pin ⑨ (Pin terminal) The signal applied here is to initiate the programmable counter.

Pin ⑩ (Pout1 terminal) The output from the programmable counter is emitted from here, and its pulse becomes 12.5 kHz when the frequency indicator is at FM 50 kHz: otherwise this terminal is at "High" level.

And here the 1 kHz pulse is available for MW or LW reception.

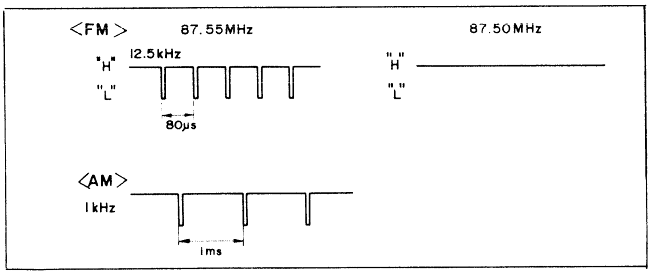


Figure 21–2

Pin ⑫ (100 kHz terminal)
The clock signal of 100 kHz is generated here.

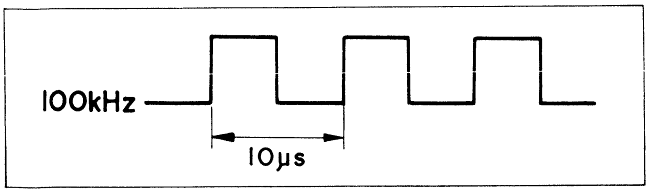


Figure 21–3

Pin ⑭ (Do - 1 terminal)
The output from the phase comparator appears here to be applied to the low-pass filter. The waveform of the signal here varies according to whether the phase of the output from the programmable counter is ahead of or behind or similar to that of the reference frequency produced by the crystal oscillator.

Upon changing the tuning frequency, the pulse has a form like spikes.

- Switching from 372 kHz to 145 kHz

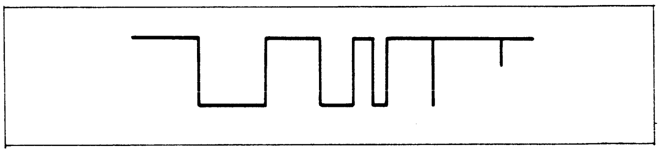


Figure 21–4

- Alternatively, switching from 145 kHz to 372 kHz

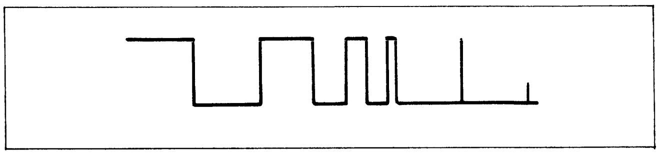


Figure 21–5

Pin ⑯ (VDD terminal) A power of 7 V is applied here, but it becomes 0 V when the power switch is turned off.

Pin ① (GROUND terminal)

3) IC500 (prescaler)

Pin ② (FMTAC terminal)
Here is observed FM local oscillation frequency — a sine wave — which is the output from the V.C.O. (voltage controlled oscillator)

Pin ⑥ (AM terminal) Here is observed AM local oscillation frequency — a sine wave — which is the output from the V.C.O.

Pin ④ (Fo terminal) For FM reception here is an output which is 1/8 division of the frequency produced by the local oscillator, and for AM reception the output remains as it was before frequency division.

Pin ⑦ (F/A terminal)	For FM reception "High" level signal is applied here.
Pin ⑨ (+50 terminal)	The output from the programmable counter here appears, and its pulse becomes 12.5 kHz when the frequency indicator is at FM 50 kHz: otherwise this terminal remains in "High" level. And here is 1 kHz pulse available for MW or LW reception.
Pin ① (Vcc terminal)	A power of 5 V is here applied, and it becomes 0 V when the power switch is turned off.
Pin ⑤ (GROUND terminal)	

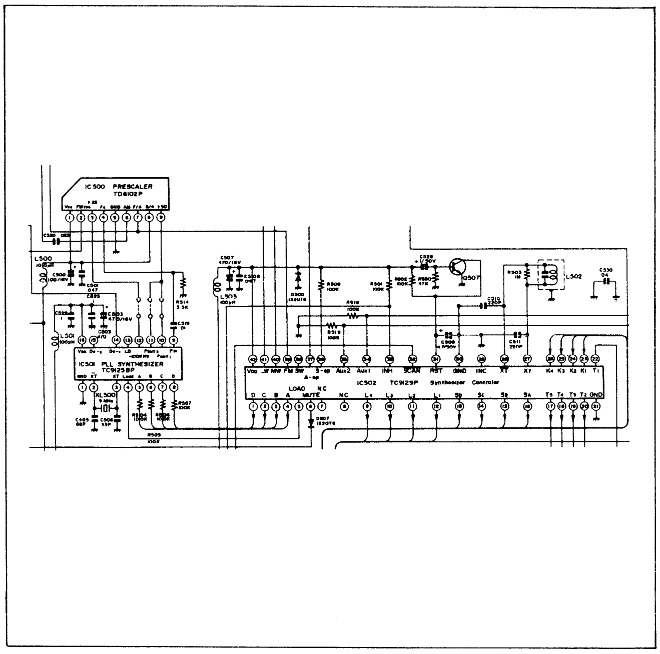

IC500 PRESCALER TD6102P
IC501 PLL SYNTHESIZER TC9125BP
IC502 TC9129P Synthesizer Controller
Q507
L500
L501
L502
L503

Figure 22–1

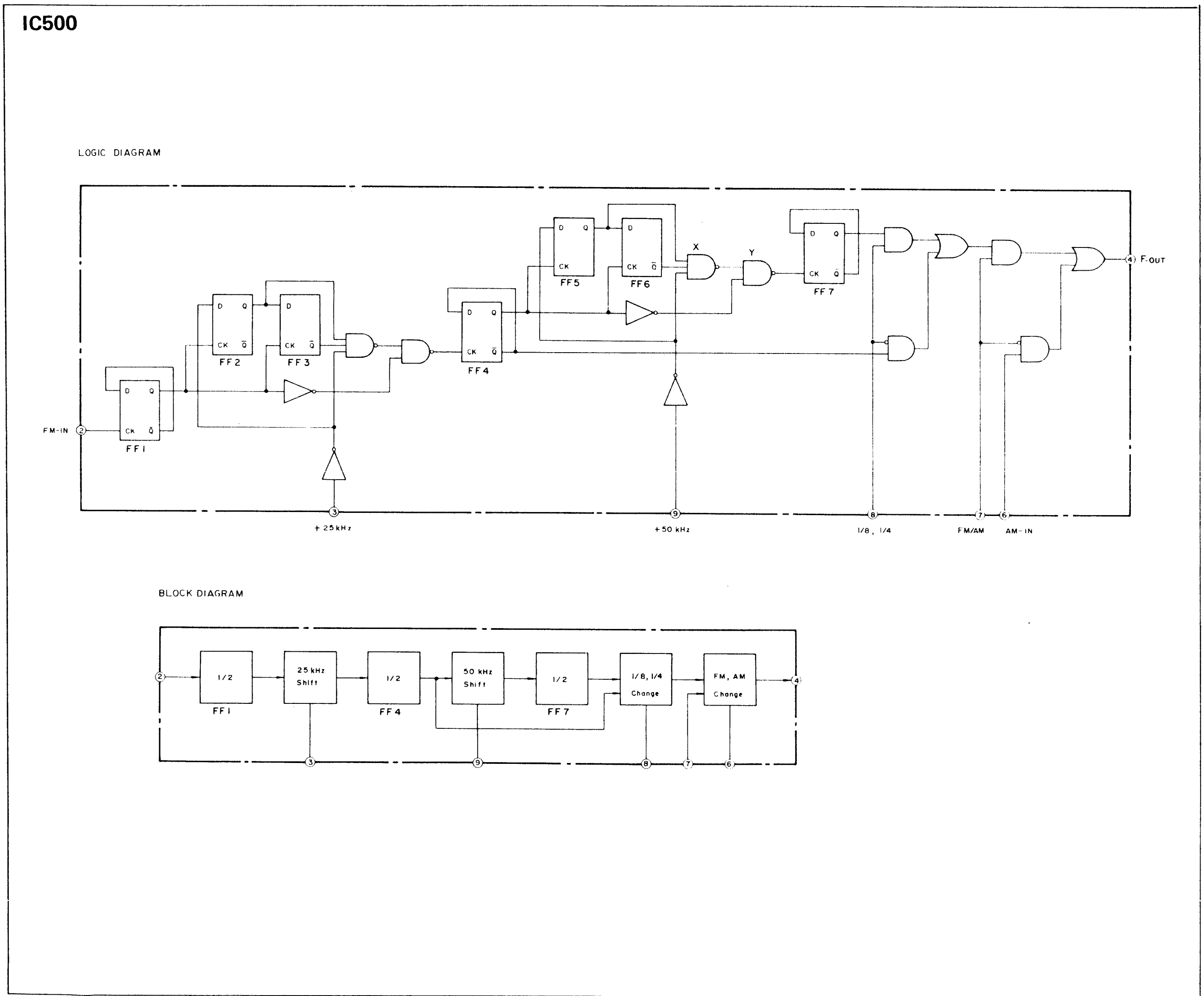

IC500
LOGIC DIAGRAM
FM-IN
FF1
FF2
FF3
FF4
FF5
FF6
FF7
X
Y
F-OUT
+25kHz
+50 kHz
1/8, 1/4
FM/AM
AM-IN
BLOCK DIAGRAM
1/2
25 kHz Shift
50 kHz Shift
1/8, 1/4 Change
FM, AM Change

Figure 22–2

IC501

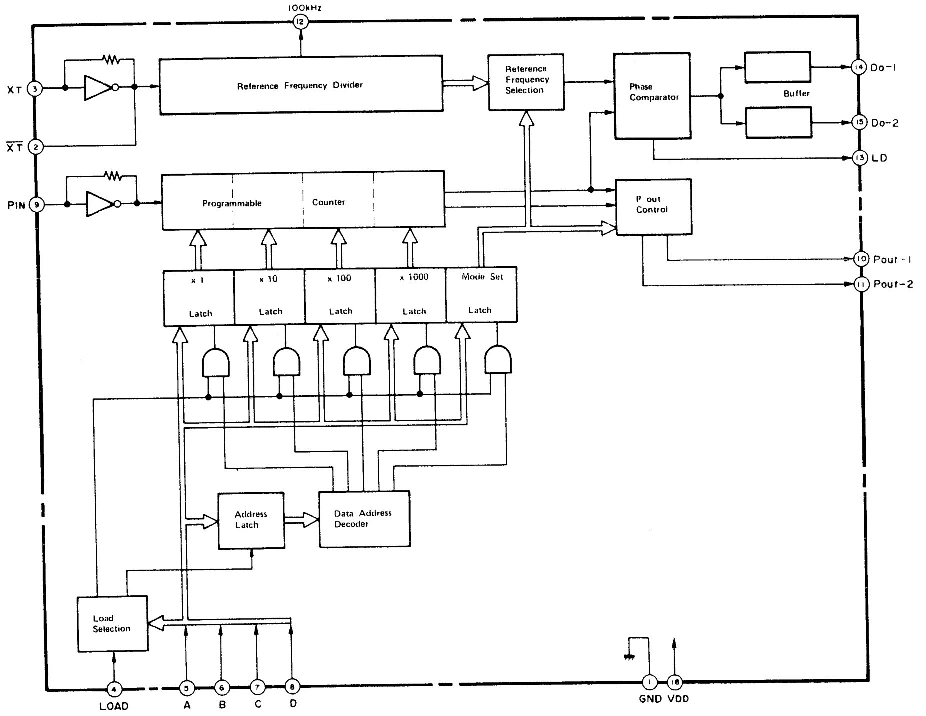

100kHz
12
XT 3
XT 2
PIN 9
Reference Frequency Divider
Reference Frequency Selection
Phase Comparator
Buffer
14 Do-1
15 Do-2
13 LD
Programmable Counter
P out Control
10 Pout-1
11 Pout-2
x 1 Latch
x 10 Latch
x 100 Latch
x 1000 Latch
Mode Set Latch
Address Latch
Data Address Decoder
Load Selection
4 LOAD
5 A
6 B
7 C
8 D
1 GND
16 VDD

Figure 23–1

IC502

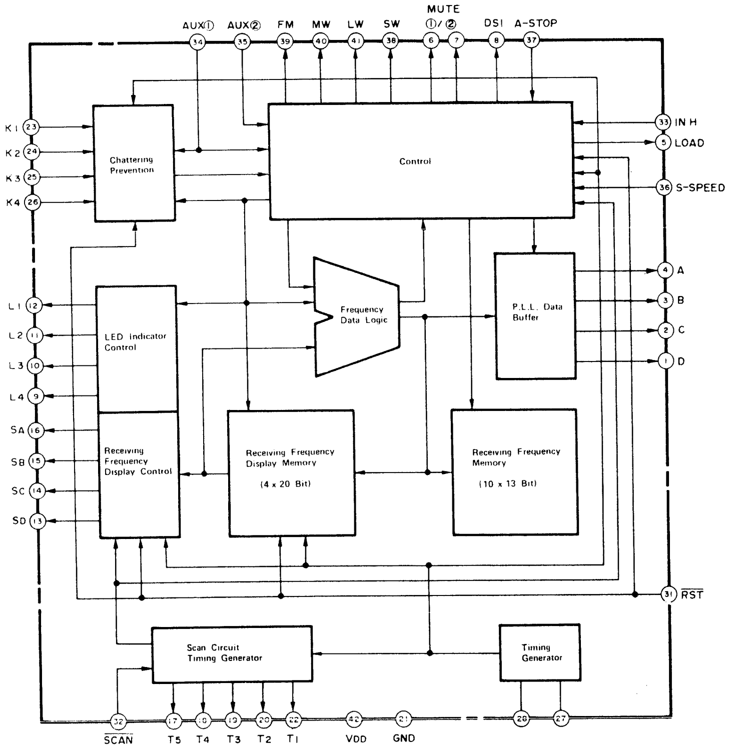

AUX① 34
AUX② 35
FM 39
MW 40
LW 41
SW 38
MUTE ①/② 6 7
DSI 8
A-STOP 37
K1 23
K2 24
K3 25
K4 26
Chattering Prevention
Control
33 INH
5 LOAD
36 S-SPEED
Frequency Data Logic
P.L.L. Data Buffer
4 A
3 B
2 C
1 D
L1 12
L2 11
L3 10
L4 9
LED Indicator Control
SA 16
SB 15
SC 14
SD 13
Receiving Frequency Display Control
Receiving Frequency Display Memory (4 x 20 Bit)
Receiving Frequency Memory (10 x 13 Bit)
31 RST
Scan Circuit Timing Generator
Timing Generator
32 SCAN
17 T5
18 T4
19 T3
20 T2
22 T1
42 VDD
21 GND
28
27

Figure 23–2

■ P.L.L. FREQUENCY SYNTHESIZER SYSTEM

This frequency synthesizer system, making use of P.L.L. (Phase Locked Loop) circuit, is intended to permit the tuner unit to provide a most stabilized local oscillation.

1. What is P.L.L. ?

P.L.L. is abbreviation of Phase-Locked-Loop which synchronizes with frequency and phase of the stable standard input (crystal oscillation) given from the outside, namely working not only as automatic frequency control but also as automatic phase control.

The P.L.L. is now used to realize a synthesizer. Consisting of one crystal, the synthesizer serves as an oscillator to oscillate step by step in the receiver section range. Therefore, this synthesizer can be said to be on the same level in the connection with the accuracy and stability of oscillation as the crystal oscillator.

2. Operating principle of the prescaler-based digital P.L.L. frequency synthesizer system

There are now many P.L.L. frequency synthesizer systems. Out of them, the ST-5200H/HB employs the prescaler-based digital P.L.L. frequency synthesizer system. Hereunder, we will brief its operating principle.

Our P.L.L. frequency synthesizer system, a prescaler-based digital one, comprises the following six devices in its basic architecture.

1. Reference-frequency divider (REF) : $f_{ref.}$
2. Phase comparator (PC) : $f\Delta\theta$
3. Low-pass filter (LPF) : $V\theta$
4. Voltage controlled oscillator (VCO) : $fvco$
5. Prescaler (PS) : $1/P$
6. Programmable divider (PD) : $1/N$

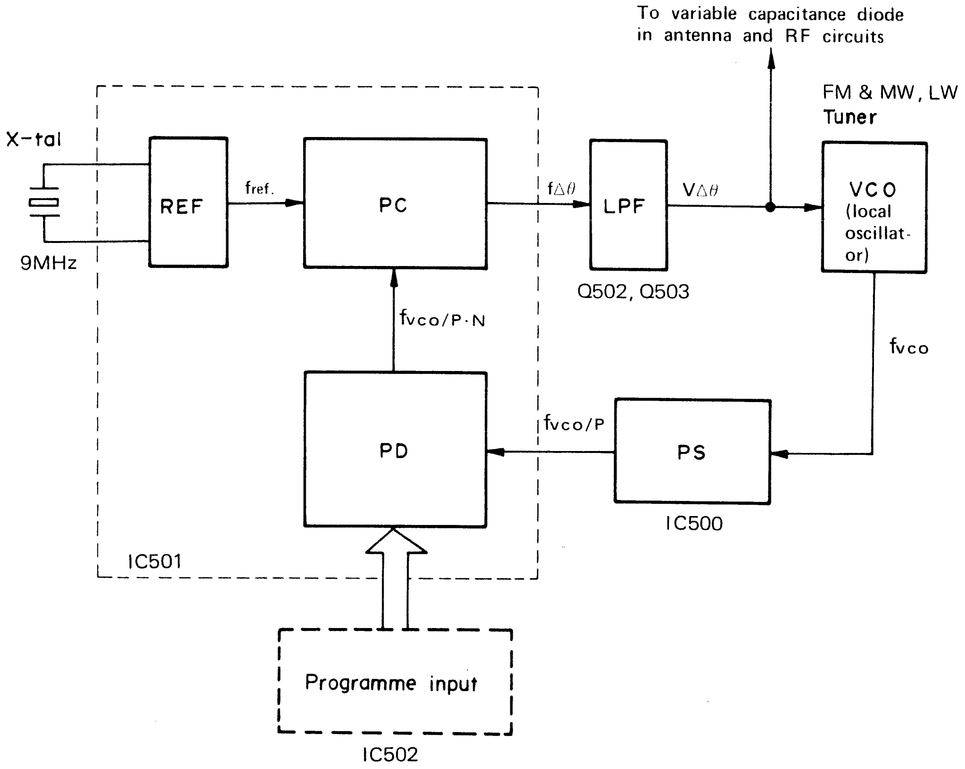


Figure 24

The ECL prescaler IC (IC500) has the duty to lessen, when it encounters a high frequency input signal — its frequency is far beyond the maximum operating frequency — whose V.C.O. signal frequency ($fvco$) is too high for the programmable divider (PD) inside the P.L.L. synthesizer IC (IC501) to divide, that high V.C.O. signal frequency ($fvco$) by prior frequency division down to a level low enough for the said divider to be able to deal with.

In this way, such high V.C.O. signal frequency ($fvco$) is first divided by the above-mentioned prescaler into $fvco/P$ equivalents and then divided through the said divider at a specified dividing rate N; the programmable divider output, which is $fvco/P \times 1/N = fvco/P{\cdot}N$ in frequency, is sent to the phase comparator.

The comparator compares the then input — a signal of $fvco/P{\cdot}N$ in frequency — with a reference frequency signal ($f_{ref.}$) about phase and frequency and creates either of two different pulses depending on whether the former's phase is ahead or behind. These pulses are thereafter converted by the low-pass filter (LPF) — composed of transistors Q502 and Q503 — to a DC voltage, large or small one.

Hence, if

$f_{ref.} > fvco/P{\cdot}N$, $V\Delta\theta$ further increases, and if

$f_{ref.} < fvco/P{\cdot}N$, $V\Delta\theta$ further decreases.

And finally, this P.L.L. loop is locked in such frequency relations as

$f_{ref.} = fvco/P{\cdot}N$

The relations can be also expressed by the equation

$fvco = P{\cdot}N{\cdot}f_{ref.}$ -------------- Equation ① in which P stands for a fixed constant — a frequency dividing rate of the prescaler and $f_{ref.}$ the divided one of oscillation frequency that is delivered from the crystal oscillator exceptionally stable against the environmental change, including changes in temperature and humidity, as well as against deterioration with age.

Accordingly, programming the N — a frequency dividing rate of the programmable divider — shown in the above equation by any method will enable the extremely exact and stable creation of receiver local oscillation frequency (V.C.O. signal frequency).

Besides, the prescaler-based system exhibits the following relations of channel space (f_{ch}) and P.

f_{ch} = P·$f_{ref.}$ ------------------ Equation ②

3. Details of the digital P.L.L. frequency synthesizer system built in the ST-5200H/HB

The relations between the frequency dividing rate of the programmable divider (PD) — N — and the local oscillation frequency (V.C.O. signal frequency) — fvco — can be expressed as follows, combining Equations ① and ② above.

f_{vco} = P·N·$f_{ref.}$ = N·f_{ch} --------- Equation ③

Besides, if receiving frequency is represented by f_{in} and intermediate frequency by f_{if},

f_{vco} = f_{in} + f_{if} --------------- Equation ④

Hence, f_{in} + f_{if} = N·f_{ch} ---------- Equation ⑤

The ST-5200H/HB shows the following relations.

	LW band		MW band	
P	1		1	
f_{in}	145 ~ 372	(kHz)	522 ~ 1611	(kHz)
f_{if}	450	(kHz)	450	(kHz)
$f_{ref.}$	1	(kHz)	1	(kHz)
f_{ch}	1	(kHz)	1	(kHz)

	FM band	
P	8	
f_{in}	87.50 ~ 108.00	(MHz)
f_{if}	10.70	(MHz)
$f_{ref.}$	12.5	(kHz)
f_{ch}	100	(kHz)

--- Equation ⑥

For LW, MW band reception, provided f_{in} = n, the equation below is generally established by combining Equations ⑤ and ⑥: n + 450 = N x 1.

Thus, N = n + 450 ----------- Equation ⑦

This equation reveals that the frequency dividing rate — a variable (N) — of the programmable divider is set at receiving frequency (f_{in} = n) plus 450 — intermediate frequency (f_{if}).

Likewise, provided f_{in} = n' x 100 (kHz) ($875 \leqq n' \leqq 1080$) for FM band reception, n' x 100 (kHz) + 10.7 x 1000 (kHz) = N x 100.

Thus, N = n' + 107 ---------- Equation ⑧

This manifests that the N (frequency dividing rate of the programmable divider) is set at the upper three digits of receiving frequency (f_{in}) plus 107 — the upper three digits of intermediate frequency (f_{if}).

In consideration that the intermediate frequency (f_{if}) is equal to the difference between receiving frequency (f_{in}) and local oscillation frequency — V.C.O. signal frequency (f_{vco}) — the P.L.L. synthesizer IC (IC501) is given a function to work so that the frequency dividing rate N (of the programmable divider) is determined by adding 450 or 107 — either equaling intermediate frequency — to receiving frequency data (n or n'). Thus, the N is decided only by giving the n or n' alone from the exterior, realizing the simple operation of the whole system.

Band	Channel space (f_{ch})	Receiving frequency band (f_{in})	Intermediate frequency (f_{if})	Local oscillation frequency (f_{vco})	Reference frequency ($f_{ref.}$)	Programmable counter frequency dividing rate (N)	Pre-scaler (P)
FM	100 (kHz)	87.50 ~ 108.00 (MHz)	10.70 (MHz)	98.20 ~ 118.70 (MHz)	12.5 (kHz)	982 ~ 1187	8
LW	1 (kHz)	145 ~ 372 (kHz)	450 (kHz)	595 ~ 822 (kHz)	1 (kHz)	595 ~ 822	1
MW	1 (kHz)	522 ~ 1611 (kHz)	450 (kHz)	972 ~ 2061 (kHz)	1 (kHz)	972 ~ 2061	1

Note: For FM band, the channel space of this unit is in principle set at 100 kHz. However, connecting the P.L.L. synthesizer IC (IC501) terminal ⑩ (P-out1) to the prescaler IC (IC500) terminal ⑨ (+50 kHz) enables the unit also to receive the broadcasts of 50-kHz-spaced channels that can be enjoyed in a part of Europe. For details consult the following paragraph "Method of adding the 50-kHz-channel spacing function."

ALIGNMENT INSTRUCTIONS

Alignment is an exacting procedure and should be undertaken only when necessary. If alignment of (LW, MW) and FM is required, either section may be done first. The FM stereo section, however, should be done only if the FM monaural section is properly adjusted.

REQUIRED EQUIPMENT

1. Signal generator with a frequency range of 137kHz to 1611kHz; (LW, MW)
2. Signal generator with a frequency range of 87.5MHz to 108.0MHz; FM
3. Vacuum tube voltmeter (AC-VTVM)
4. Sweep signal generator with a sweep range of at least 500kHz and center frequency of 10.7MHz with at least a 10.7MHz marker may be used. (For FM)
5. Sweep signal generator with a sweep range of at least 50kHz and center frequency of 450kHz with at least a 450kHz marker may be used. (For AM)
6. Oscilloscope with a wide range amplifier of approximately 100kHz.
7. Test loops, a coil of any size wire, one turn or more; (LW, MW)
8. Vacuum tube voltmeter (DC-VTVM)
9. FM stereo signal generator.
10. Audio signal generator with a frequency range of 20Hz to 100kHz.
11. Frequency counter with a frequency range of approximately 100kHz.

Notes:

Allow the set at least five minutes to warm up before attempting alignment. During alignment keep the signal generator output at the lowest level that will maintain a usable output from the set.

For the adjustment of stereo separation, the FM stereo generator output is usually 1,000μV. Incorrect grounding to the metal chassis may pick up an unwanted 10.7MHz signal from the final IF stage, which will cause a regenerative sweep response on the sweep curve and result in misalignment.

Therefore always connect a ground to point.

Ground connection of signal generator:	Chassis ground
Generator modulation (AM):	30%, 400Hz
Generator modulation (FM):	40kHz, 1000Hz
Generator modulation (FM stereo):	Ch. L. or Ch. R. 40kHz, 1,000Hz Mod.

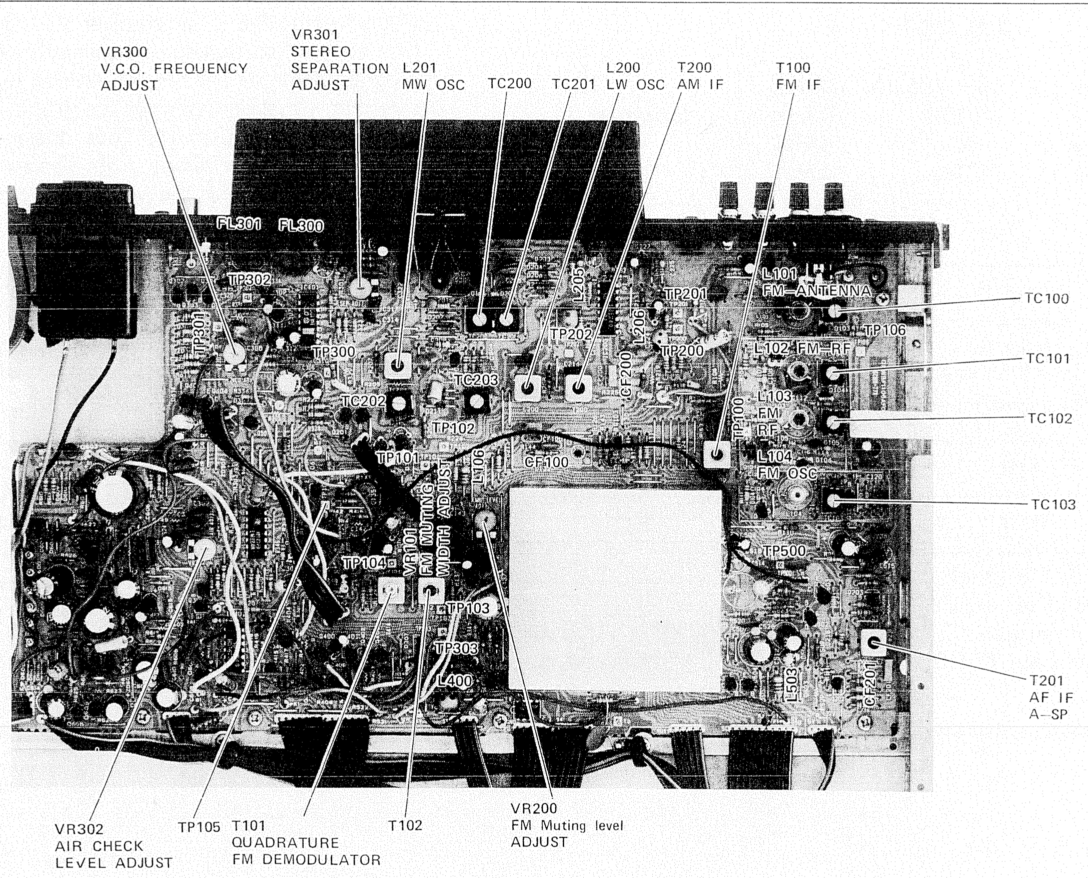

VR300
V.C.O. FREQUENCY
ADJUST
VR301
STEREO
SEPARATION
ADJUST
L201
MW OSC
TC200
TC201
L200
LW OSC
T200
AM IF
T100
FM IF
FL301
FL300
TP302
TP301
TP300
TC202
TP101
TP102
TC203
L205
TP202
L206
CF200
TP201
TP200
L101
FM ANTENNA
TP106
L102 FM-RF
L103
FM
RF
L104
FM OSC
TP100
CF100
L106
VR101
FM MUTING
WIDTH ADJUST
TP104
TP103
TP303
L400
TP500
L503
CF201
TC100
TC101
TC102
TC103
T201
AF IF
A-SP
VR302
AIR CHECK
LEVEL ADJUST
TP105
T101
QUADRATURE
FM DEMODULATOR
T102
VR200
FM Muting level
ADJUST

Figure 26

AM IF ALIGNMENT (MW, LW)

PROCEDURE NUMBER	SWEEP GENERATOR		TUNING FREQUENCY DISPLAY	SELECTOR SETTING	METER CONNECTION	ADJUSTMENT	REMARKS
	CONNECTION	FREQUENCY					
1	Entwine signal generator output in loop from around antenna coil LA200 (MW)	450 kHz (Central frequency of ceramic filter)	High end of Frequency	Band selector switch (MW)	Oscilloscope is connected between TP200 and TP201 (earth)	T200	Maximum response at 450 kHz Repeat 2 or 3 times (Figure 27–2)

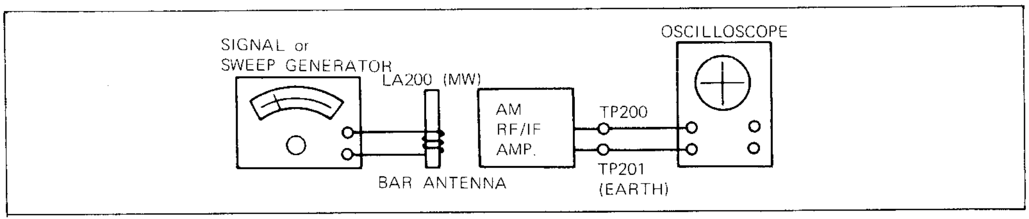


Figure 27–1 AM IF ALIGNMENT EQUIPMENT CONNECTIONS

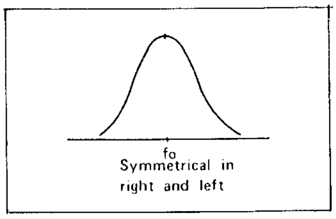


Figure 27–2 IF CURVE

LW RF ALIGNMENT

PROCEDURE NUMBER	TEST STAGE	SIGNAL GENERATOR		TUNING FREQUENCY DISPLAY	METER CONNECTION	ADJUSTMENT	REMARKS
		CONNECTION	FREQUENCY				
1	V.C.O.			Low end of frequency (145 kHz)	Connect the VTVM (vacuum tube voltmeter) between the L.P.F terminal TP500 and the ground (earth).	Local oscillation coil L200.	Adjust the L200 so that the said voltmeter reads 2.0 ± 0.1V.
2				High end of frequency (372 kHz).	Same as above	Oscillation trimmer TC203	Adjust the TC203 so that the voltmeter reading reaches 19.0 ± 0.2V.
3	Press the number input keys "7" and "8" – Whose corresponding memories have been individually loaded with "LW" 137 kHz" and "LW 372 kHz" by the operations so far made – alternately to check the voltages measured when the voltage setting is at LW 145 kHz and LW 372 kHz. If those voltages deviate from specified values, readjustment is needed.						
4	Tracking	Connect AM signal generator to the loop antenna and place this assembly at near the bar antenna coil (LA200) Fix the AM signal generator output at some 55 dB (560μV/m).	173 kHz (400 Hz, 30%, AM modulated)	frequency (173 kHz)	Connect the VTVM (vacuum tube voltmeter) to the output socket	AM bar antenna coil LA200 (LW)	Make the output be the maximum.
5		Same as above	344 kHz (400 Hz, 30%, AM modulated)	frequency (344 kHz)	Same as above	Antenna trimmer TC201.	Same as above
6	Repeat the steps 4 to 5 until no further improvement can be made.						
7	Auto-Stop Signal (ASS)	Connect AM signal generator to the loop antenna and place this assembly at near the bar antenna coil (LA200). Set the AM signal generator output at about 56 dB.	Same as step 5.		Connect a DC voltmeter between the test point TP303 and the ground (earth).	T201	Adjust both the T201 so that the reading of the said DC voltmeter (TP303) reaches its maximum. (If the reading is then more than 10 V, reduce the AM signal generator output level to maintain the reading less than 10 V.)
8		Adjust the frequency and output settings of AM signal generator respectively to 344 kHz and about 57 dB (710μV/m). In such a machine state, check to see if the ST-5200H/HB automatically stops the scanning – both upward and downward scannings – at the 344 kHz position and receives a signal of that frequency when it is compelled to scan the both ways, up and down, in the automatic tuning mode. If the unit fails to automatically stop scanning, repeat step 7 above.					

MW RF ALIGNMENT

PROCEDURE NUMBER	TEST STAGE	SIGNAL GENERATOR		TUNING FREQUENCY DISPLAY	METER CONNECTION	ADJUSTMENT	REMARKS
		CONNECTION	FREQUENCY				
1	V.C.O.			Low end of frequency (522 kHz)	Connect the VTVM (vacuum tube voltmeter) between the L.P.F terminal TP500 and the ground (earth).	Local oscillation coil L201.	Adjust the L201 so that the said voltmeter reads 1.5 ±0.1V.
2				High end of frequency (1611 kHz).	Same as above	Oscillation trimmer TC202	Adjust the TC202 so that the voltmeter reading reaches 21.0 ± 0.2V.
3	Press the number input keys "4" and "5" – Whose corresponding memories have been individually loaded with "MW" 522 kHz" and "MW 1611 kHz" by the operations so far made – alternately to check the voltages measured when the voltage setting is at MW 522 kHz and MW 1611 kHz. If those voltages deviate from specified values, readjustment is needed.						
4	Tracking	Connect AM signal generator to the loop antenna and place this assembly at near the bar antenna coil (LA200) Fix the AM signal generator output at some 55 dB (560μV/m).	612 kHz (400 Hz, 30%, AM modulated)	frequency (612 kHz)	Connect a VTVM (vacuum tube voltmeter) to the output socket	AM bar antenna coil LA200 (MW)	Make the output be the maximum.
5		Same as above	1404 kHz (400 Hz, 30%, AM modulated)	frequency (1404 kHz)	Same as above	Antenna trimmer TC200.	Same as above
6	Repeat the steps 4 to 5 until no further improvement can be made.						
7	Auto-Stop Signal (ASS)	Connect AM signal generator to the loop antenna and place this assembly at near the bar antenna coil (LA200). Set the AM signal generator output at about 56 dB.	Same as step 5.		Connect a VTVM (vacuum tube voltmeter) between the test point TP303 and the ground (earth).	T201	Adjust both the T201 so that the reading of the said DC voltmeter (TP303) reaches its maximum. (If the reading is then more than 10 V, reduce the AM signal generator output level to maintain the reading less than 10 V.)
8		Adjust the frequency and output settings of AM signal generator respectively to 1404 kHz and about 57 dB (710μV/m). In such a machine state, check to see if the ST-5200H/HB automatically stops the scanning – both upward and downward scannings – at the 1404 kHz position and receives a signal of that frequency when it is compelled to scan the both ways, up and down, in the automatic tuning mode. If the unit fails to automatically stop scanning, repeat step 7 above.					

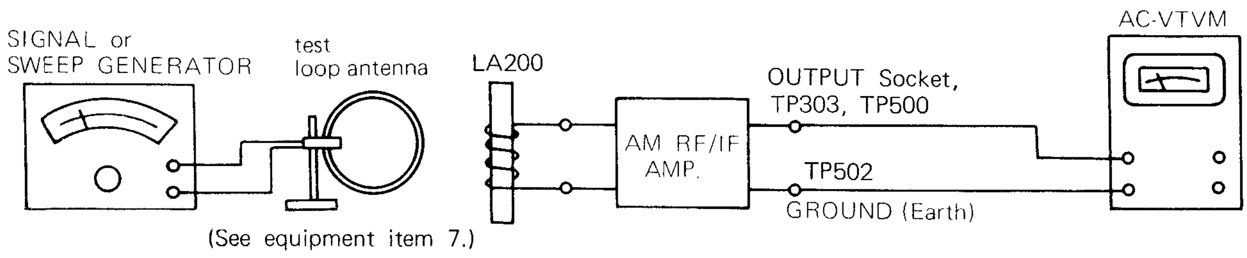


Figure 28 LW, MW, RF ALIGNMENT EQUIPMENT CONNECTIONS

FM IF/RF ALIGNMENT

Push the "FM mono" key of this unit to put it in the "FM mono" position. (Check then that the FM mono indicator LED is on.)

PROCEDURE NUMBER	TEST STAGE	SIGNAL GENERATOR		TUNING FREQUENCY DISPLAY	METER CONNECTION	ADJUSTMENT	REMARKS
		CONNECTION	FREQUENCY				
1	IF	Connect FM sweep generator to test point L105 through 6pF capacitor. The earth is to be connected with the test point TP201 (Keep the output be closed as much as possible)	Central frequency of ceramic filter (10.700 MHz)	High end of frequency (108.00 MHz)	Connect oscilloscope to the test points TP102 and TP302 (ground)	T100	Rotate the cores of T100 so that the waveform becomes symmetrical and highest as shown in Fig. 30–2.
2	V.C.O.			Low end of frequency (87.50MHz)	Connect the VTVM (vacuum tube voltmeter) between the L.P.F terminal TP500 and the ground (earth).	Local oscillation coil L104.	Adjust the L104 so that the said voltmeter reads 3.0 ± 0.1V.
3				High end of frequency. (108.00MHz)	Same as above	Oscillation trimmer TC103	Adjust the TC103 so that the voltmeter reading reaches 21.0 ± 0.2V
4	Press the number input keys "3" and "4" – Whose corresponding memories have been individually loaded with "FM" 87.50MHz" and "FM 108.00MHz" by the operations so far made – alternately to check the voltages measured when the voltage setting is at FM 87.50MHz and FM 108.00MHz. It those voltages deviate from specified values readjustment is needed.						
5	Distortion	Connect the FM signal generator to the test point L105 with a 6pF capacitor connected between them. The ground is to be connected to the test point TP201 . Fix the FM signal generator output so that the generator delivers a monaural signal of about 80 dB.	10.700 MHz (1 kHz, 40 kHz dev., FM modulated)	Same as step 1 above	Connect a distortion factormeter to the output terminal	T101	Adjust T101 so that the meter reads minimum.
6		Connect the FM signal generator to the test point L105 with a 6pF capacitor connected between then. Connect the ground to the test point TP201 .	10.700 MHz (40 kHz dev., 1kHz).	Same as step 1 above	Connect the VTVM (vacuum tube voltmeter) between the tuner test points TP104 and TP103 .	T102	Adjust the T102 so that the VTVM- (vacuum tube voltmeter) reads less than 0,01 V and that the then distortion factor reaches its minimum.
7	Repeat the steps 1 to 4 until no further improvement can be made.						
8	Tracking (* A)	Connect FM signal generator to the antenna terminal. (Keep the input be closed as much as possible.)	90MHz (1kHz, 40 kHz Dev., FM modulated.)	Tunig in 90 MHz	Connect VTVM to the output socket	L101, L102, L103	Make the output be the maximum.
9		Same as above	106 MHz (1kHz, 40kHz Dev., FM modulated.)	Tuning in 106 MHz	Same as above	TC100, TC101, TC102	Same as above
10	Repeat the steps 8 to 9 until no further improvement can be made.						

(* A) As for FM high-frequency range (front-end section), since it has been already adjusted, do not rotate the coils and trimmers unless the adjustment becomes necessary – readjust the FM-high frequency only when it suffers a considerable disalignment.

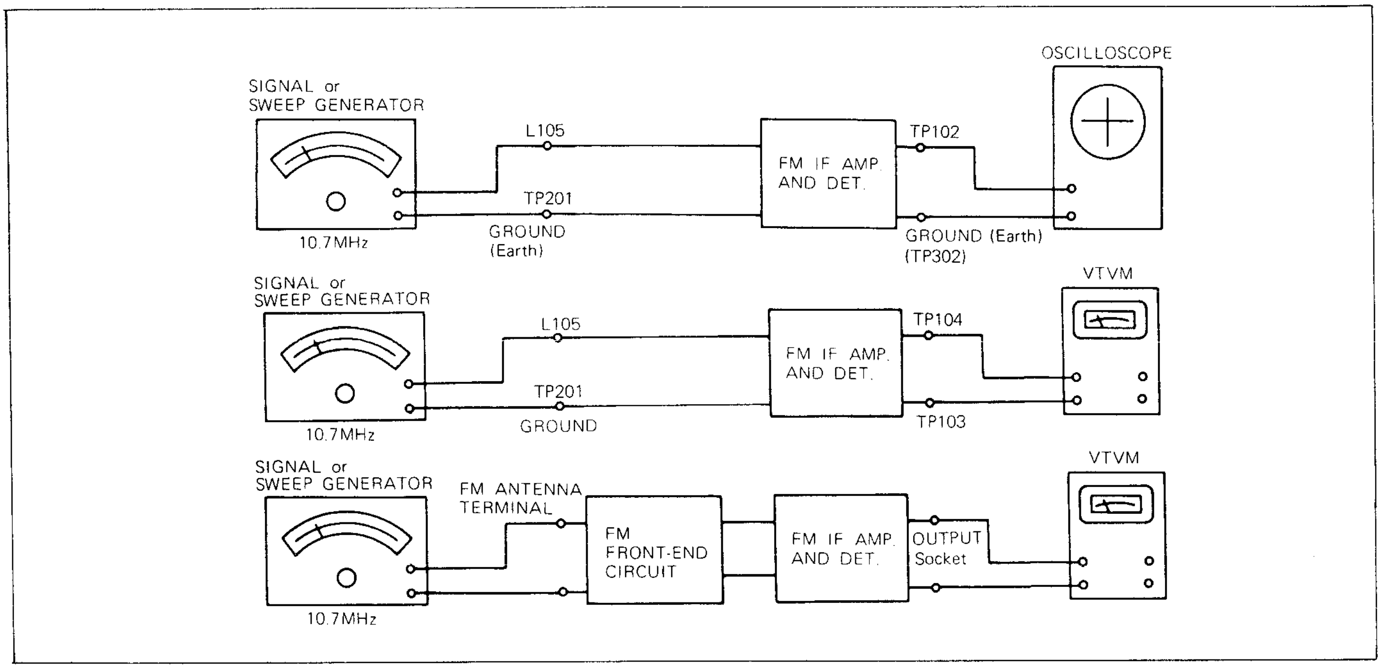

SIGNAL or
SWEEP GENERATOR
10.7MHz
L105
TP201
GROUND
(Earth)
FM IF AMP.
AND DET.
TP102
GROUND (Earth)
(TP302)
OSCILLOSCOPE
SIGNAL or
SWEEP GENERATOR
10.7MHz
L105
TP201
GROUND
FM IF AMP.
AND DET.
TP104
TP103
VTVM
SIGNAL or
SWEEP GENERATOR
10.7MHz
FM ANTENNA
TERMINAL
FM
FRONT-END
CIRCUIT
FM IF AMP.
AND DET.
OUTPUT
Socket
VTVM

Figure 30–1 FM ALIGNMENT EQUIPMENT CONNECTIONS

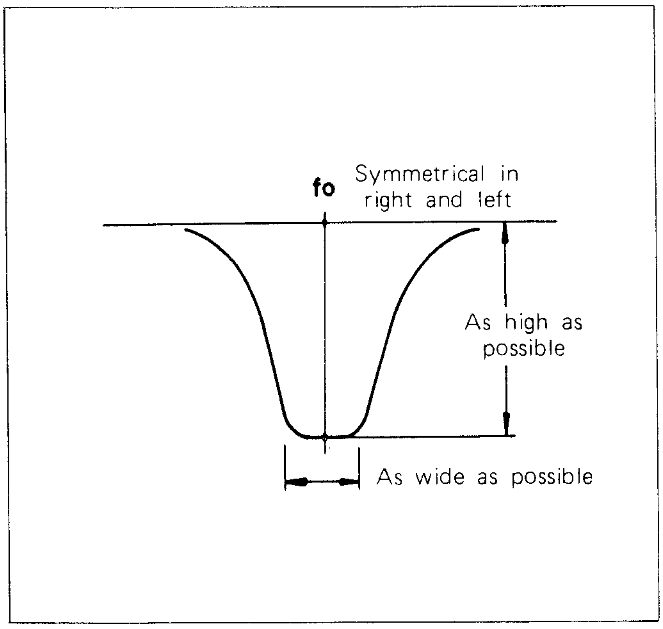

fo
Symmetrical in
right and left
As high as
possible
As wide as possible

Figure 30–2

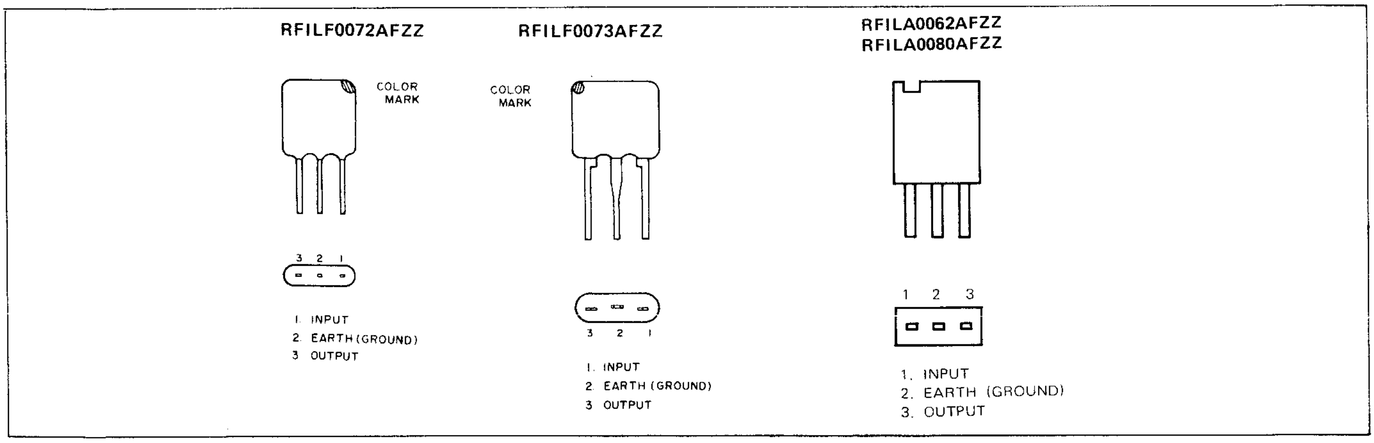

RFILF0072AFZZ
COLOR
MARK
3 2 1
1. INPUT
2. EARTH (GROUND)
3. OUTPUT
RFILF0073AFZZ
COLOR
MARK
3 2 1
1. INPUT
2. EARTH (GROUND)
3. OUTPUT
RFILA0062AFZZ
RFILA0080AFZZ
1 2 3
1. INPUT
2. EARTH (GROUND)
3. OUTPUT

Figure 30–3 CERAMIC FILTER

FM IF READJUSTMENT AND DISTORTION FACTOR ADJUSTMENT

1) Set the FM stereo switch to "ON" position.
2) Set the frequency of FM signal generator to 98 MHz (40kHz deviation, 1KHz), fully close the output and connect such signal to the FM antenna terminal of the set through a dummy resistor of 300 ohms.
3) Set the switches of the set to the respective positions shown below and turn on the power switch.
   [Hi-blend – off, Air Check – off]
4) Keeping the output of FM signal generator be fully closed (that is, with no signal given), rotate the core of T102, so that voltage between the test points TP103 and TP 104 be just 0(zero)V, too.
   (around "98 MHz" position).
5) Adjust the output of FM signal generator to 60 dB, adjust the core of T101 so that the distortion will be minimized.
6) Fully close the output of FM signal generator and make so that voltage between the test points TO103 and TO104 be just 0(zero)V, too.
7) Repeat the steps 1) to 6) until the best point will be found.
8) Connect FM stereo modulator to FM signal generator. At the time, the following should be set: modulation frequency; 1kHz, [modulation degree L+R 20kHz deviation, L – R; 20kHz deviation pilot (19kHz) 6kHz deviation. FM signal generator is being set so that the output will be 60 dB with the frequency 98 MHz.
9) Arrange the FM stereo modulator to cause modulation for only the signal at the left channel and finely adjust the T100 so as to provide a minimum distortion. (The same operation is to be made also for the right channel signal.)
10) Fully close the output of FM signal generator (the same as with no signal given) and check additionally adjust T102, so that voltage between the test points TP103 and TP104 be just 0(zero)V, too.
11) Repeat the steps 1) to 10) above until you will achieve the best tuning.

ADJUSTMENT OF AIR CHECK CAL.

Produce 98 MHz, 60 dB FM mono signal (75kHz deviation, 400 Hz) by a signal generator to apply it to the antenna of the unit and read the tuner output voltage.
Next, set Air Check/Muting switch to "air check on" position, then the output voltage will vary. Adjust semi-fixed resistor VR302 so that the output voltage with Air check/Muting switch set to "air check on" becomes about 40%(–8 dB), of that with Air Check switch kept at "air check off".

ADJUSTMENT OF FM MUTING LEVEL

(Check the signal generator output frequency by the aid of frequency counter.)

1. Press the "FM stereo" key of the ST-5200H/HB to put it in the "FM stereo" position – this actuates the FM stereo indicator LED.
2. Connect a 300 ohm dummy resistor and FM signal generator to the FM antenna terminal (300 ohm). Keep the output of FM signal generator as small as possible (to produce no signal).
3. Manipulate the FM signal generator so that it outputs a monaural signal of 98 MHz (23 dB, 400 Hz, 40 kHz dev.), and set the receiving frequency of the tuner at 98.00 MHz.
4. And manipulate the semi-variable resistor VR200 so that the muting function is activated with an FM signal generator output of 23 dB (14 µV). (antenna open voltage)

ADJUSTMENT OF FM STEREO V.C.O. FREE-RUNNING FREQUENCY, STEREO SEPARATION

(Check the signal generator output frequency by the use of frequency counter.)

1. Press the "FM stereo" key of the ST-5200H/HB to bring it to the "FM stereo" position. (This makes the FM stereo indicator LED on.)
2. Adjust the FM signal generator so as to output monaural signal of 98.000 MHz (400 Hz, 40 kHz deviation), 60 dB (1 mV) and connect it to the FM antenna terminal. Then tune in the unit with a tuner receiving frequency set at 98.00 MHz.
3. Connect the VTVM across a 3.3 Megohm resistor, to the test point TP301 and a frequency counter to the output terminal of VTVM.
4. Adjust the semi-variable resistor VR300 so that V.C.O. free-running frequency will be 76 kHz ± 76 Hz.
5. Connect the FM stereo modulator to the FM signal generator. At the time, the following setting should be made: modulation frequency; 1 kHz [L + R; 20 kHz dev., L – R; 20 kHz dev., and pilot signal (19 kHz); 6 kHz (8%) deviation].
6. Fix the FM signal generator output frequency at 98.000 MHz, 60 dB (1 mV). Connect the VTVM to the output socket of this unit.
7. Then manipulate the stereo modulator so that the left channel alone is subjected to modulation and set the then left-channel output of the ST-5200H/HB at 0 dB (output socket).
8. Connect the VTVM to the fixed output socket (R-channel) of the unit and to the ground (earth) and adjust the semi-variable resistor VR301 so that the separation becomes maximum (the output leak to the opposite channel is minimized).

   Repeat the above procedures until the outputs of both channels will be equal to each other.

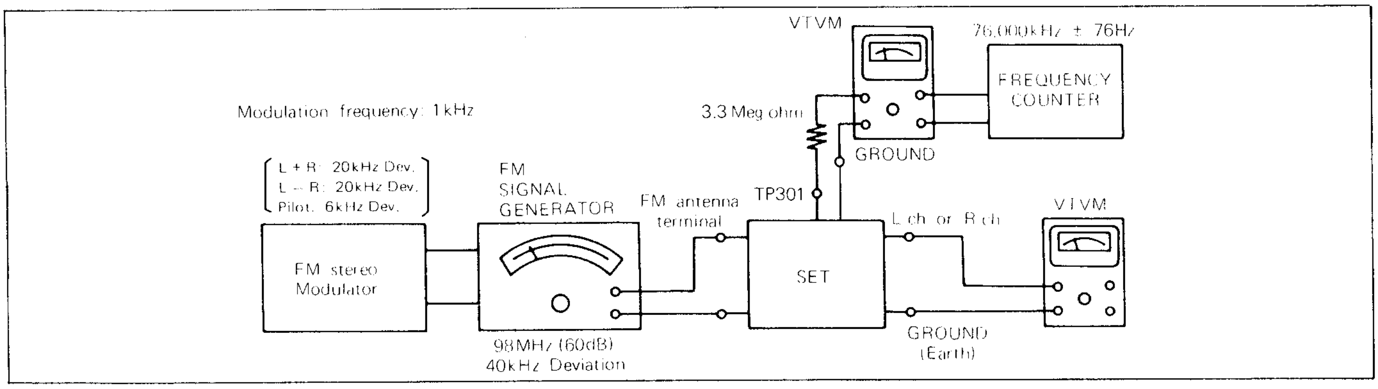

VTVM
76,000kHz ± 76Hz
FREQUENCY COUNTER
Modulation frequency: 1kHz
3.3 Meg ohm
GROUND
L + R: 20kHz Dev.
L – R: 20kHz Dev.
Pilot. 6kHz Dev.
FM SIGNAL GENERATOR
FM antenna terminal
TP301
L ch or R ch
VTVM
FM stereo Modulator
SET
98MHz (60dB)
40kHz Deviation
GROUND (Earth)

Figure 32 FM STEREO ALIGNMENT EQUIPMENT CONNECTIONS

VOLTAGES ON POSITION [Vacuum tube Voltmeter (AC–VTVM)]

	Gate ①	Gate ②	Drain	Source	Base	Collector	Emitter
Q100	1.0V	4.3V	8.8V	1.0V	–	–	–
Q101	–	–	–	–	1.7V	9.4V	1.0V
Q102	–	–	–	–	5.3V	10.4V	4.2V
Q103	–	–	–	–	2.3V	9.2V	1.7V
Q104	–	–	7.2V	–	–	–	–
Q105	–	–	–	–	4.4V	9.5V	3.9V
Q106	–	–	–	–	0.7V	0V	–
Q107	–	–	–	–	0.6V	0V	–
Q200	–	–	–	–	3V	3.5V	3.6V
Q201	–	–	–	–	–	3.5V	3.6V
Q202	–	–	–	–	2.6V	4.6V	2.0V
Q203	–	–	–	–	2.4V	11V	1.8V
Q300	–	–	–	–	0.1V	0V	–

	Gate ①	Gate ②	Drain	Source	Base	Collector	Emitter
Q301	–	–	–	–	0V	0V	–
Q302	–	–	–	–	0V	–	–
Q303	–	–	–	–	0V	–	–
Q304	–2.6V	–	0V	0V	–	–	–
Q305	–	–	–	–	4.3V	–5.6V	4.7V
Q306	–	–	–	–	0.6V	0V	–
Q400	–	–	–	–	0.1V	5V	–
Q401	–	–	–	–	0V	0.7V	–
Q402	–	–	–	–	0.7V	0V	–
Q403	–	–	–	–	0V	–	–
Q404	–	–	–	–	0.7V	0V	–
Q405	–	–	–	–	0.6V	0.7V	–
Q406	–	–	–	–	0V	4.7V	–

	Gate ①	Gate ②	Drain	Source	Base	Collector	Emitter
Q407	–	–	–	–	0.1V	4.7V	–
Q408	–	–	–	–	0.7V	0V	–
Q500	–	–	–	–	0.6V	0V	–
Q501	–	–	–	–	0.7V	0.1V	–
Q502	1V	–	–	24V	–	–	–
Q503	–	–	–	–	0.7V	3.1V	–
Q504	–	–	–	–	2.4V	11.4V	–
Q505	–	–	–	–	11V	0.1V	11.4V
Q506	–	–	–	–	0.6V	0V	–
Q507	–	–	–	–	0V	5V	–

	Gate ①	Gate ②	Drain	Source	Base	Collector	Emitter
Q600	–	–	–	–	27V	40V	27.2V
Q601	–	–	–	–	27V	40V	27.2V
Q602	–	–	–	–	12.6V	–	–
Q603	–	–	–	–	10.5V	–	–
Q604	–	–	–	–	7.74V	–	–
Q605	–	–	–	–	5.6V	–	–
Q606	–	–	–	–	0V	1.0V	–
Q607	–	–	–	–	0.6V	0.12V	–
Q608	–	–	–	–	0.7V	0V	–
Q609	–	–	–	–	26.5V	–	–

	PIN ①	PIN ②	PIN ③	PIN ④	PIN ⑤	PIN ⑥	PIN ⑦	PIN ⑧	PIN ⑨	PIN ⑩	PIN ⑪	PIN ⑫	PIN ⑬	PIN ⑭	PIN ⑮	PIN ⑯
IC100	2V	2V	2V	0V	0V	5.5V	5.5V	5.7V	5.7V	5.7V	11.6V	4V	–	–	4.8V	–
IC101	11V	3.7V	2.4V	4V	8.7V	8.7V	4V	0V	3.6V	2.5V	2.3V	3.9V	2.4V	2.4V	2.4V	3.1V
IC200	4.7V	1.8V	10V	5.8V	10V	3.4V	1.3V	2.8V	7.6V	0V	10.8V	1.6V	0.7V	1.6V	0V	1.2V
IC400	–	–	5V	5V	–	4.7V	0V	–	–	–	–	–	–	5V	–	–
IC401	–	4.7V	5V	5V	–	4.7V	5V	–	–	–	–	–	4.7V	5V	–	–
IC500	5V	2.7V	4.3V	3.5V	0V	4.2V	4.8V	5V	7.2V	–	–	–	–	–	–	–
IC501	0V	3.5V	3.3V	–	–	–	–	–	3.4V	7.2V	7.0V	4.0V	–	0.9V	–	7.2V
IC503	–	–	–	–	–	–	12V	–	–	–	–	–	–	–	–	–
IC700	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	5V
IC701	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	5V
IC702	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	5V

	PIN ㉗	PIN ㉘	PIN ㉛	PIN ㉝	PIN ㊱	PIN ㊲	PIN ㊷
IC502	2V	2V	5V	5V	5V	0.1V	5V

VHIHA11225/-1 (HA11225)

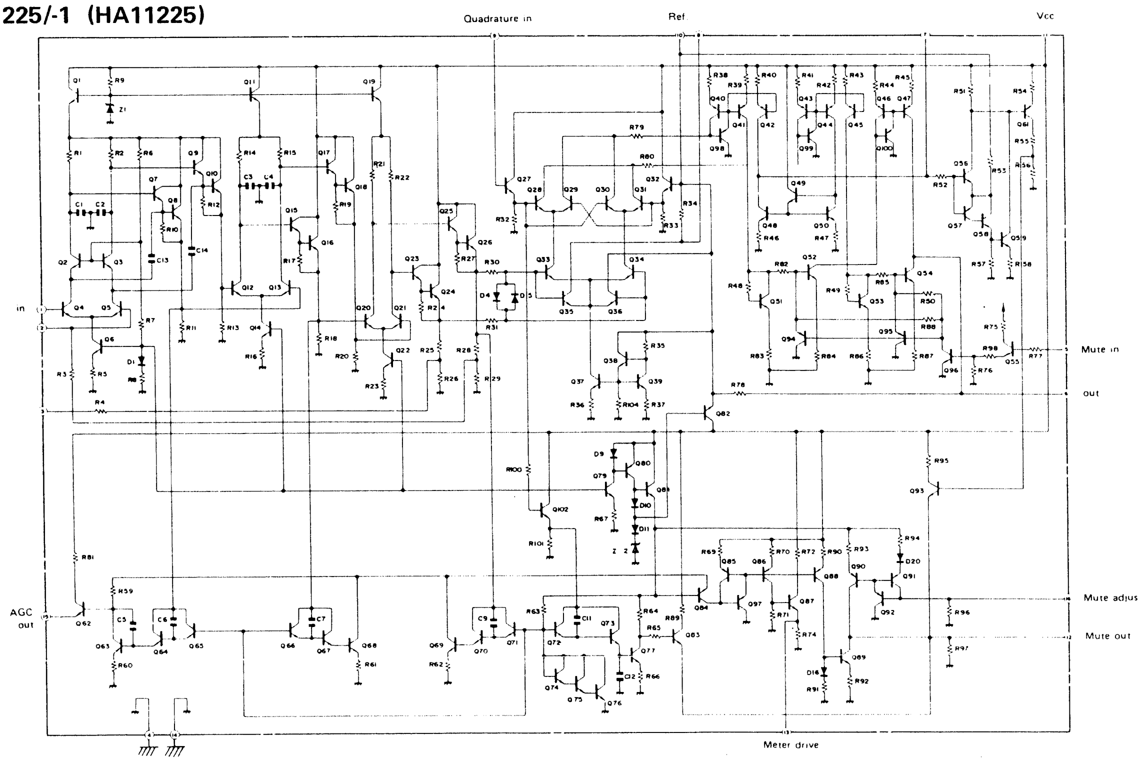


Figure 33

VHIHA12016/-1 (HA12016)

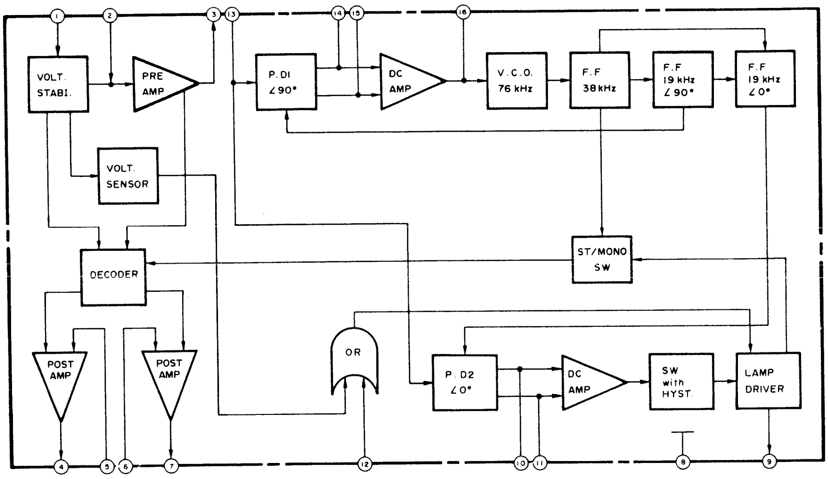

VOLT. STABI.
PRE AMP
VOLT. SENSOR
DECODER
POST AMP
POST AMP
OR
P. DI ∠90°
DC AMP
V.C.O. 76 kHz
F.F 38 kHz
F.F 19 kHz ∠90°
F.F 19 kHz ∠0°
ST/MONO SW
P. D2 ∠0°
DC AMP
SW with HYST
LAMP DRIVER
1
2
3
13
14
15
16
4
5
6
7
12
10
11
8
9

Figure 34–1

VHILA1240//-1 (LA1240)

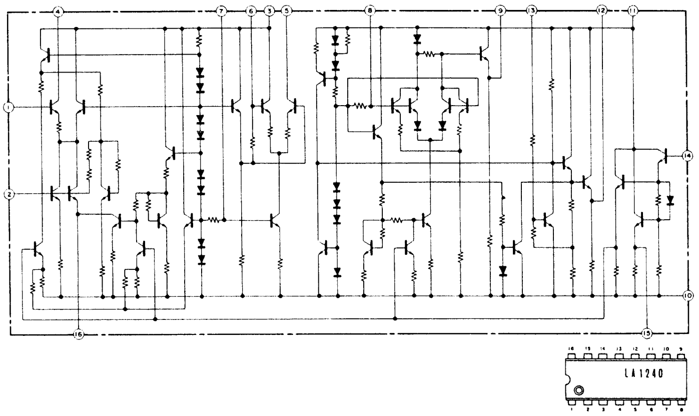


Figure 34–2

VHILM324///-1 (LM324)

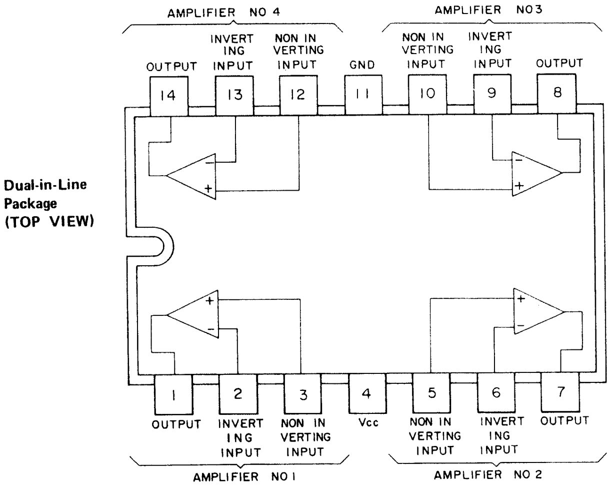

AMPLIFIER NO 4
AMPLIFIER NO3
OUTPUT
INVERTING INPUT
NON INVERTING INPUT
GND
NON INVERTING INPUT
INVERTING INPUT
OUTPUT
14
13
12
11
10
9
8
Dual-in-Line Package (TOP VIEW)
1
2
3
4
5
6
7
OUTPUT
INVERTING INPUT
NON INVERTING INPUT
Vcc
NON INVERTING INPUT
INVERTING INPUT
OUTPUT
AMPLIFIER NO 1
AMPLIFIER NO 2

Figure 34–3

RH-IX1206AFZZ (HD7473P or SN7473N or M53273P)

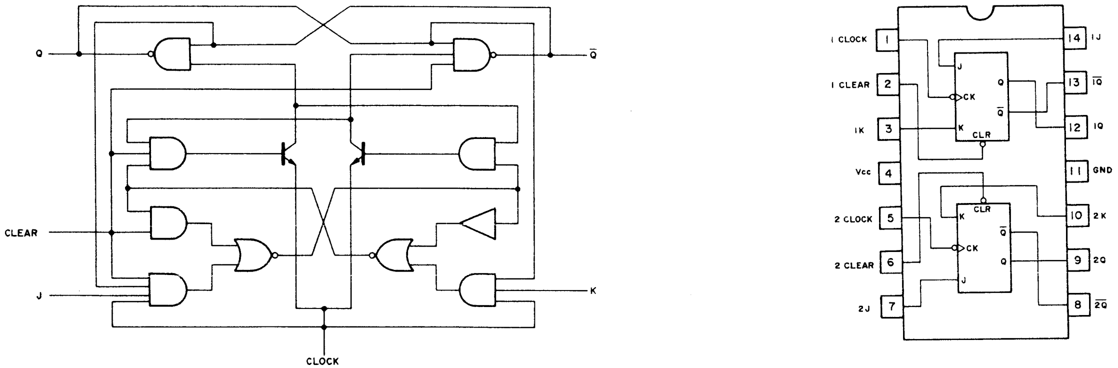

Q
$\overline{Q}$
CLEAR
J
K
CLOCK
1 CLOCK
1 CLEAR
1K
Vcc
2 CLOCK
2 CLEAR
2J
1
2
3
4
5
6
7
14
13
12
11
10
9
8
1J
$\overline{1Q}$
1Q
GND
2K
2Q
$\overline{2Q}$
J
CK
K
CLR
Q
$\overline{Q}$

Figure 35–1

VHITD6102P/-1 (TD6102P) Block Diagram ....See page 22 (Figure 22–2)

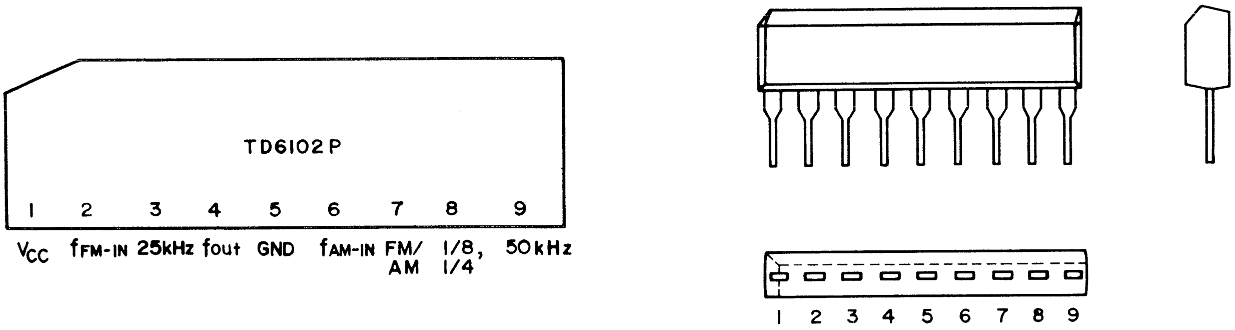

TD6102P
1
2
3
4
5
6
7
8
9
V_{CC}
$f_{FM\text{-}IN}$
25kHz
fout
GND
$f_{AM\text{-}IN}$
FM/AM
1/8, 1/4
50kHz
1 2 3 4 5 6 7 8 9

Figure 35–2

VHITC9125BP-1 (TC9125BP) Block Diagram .... See page 23 (Figure 23–1)

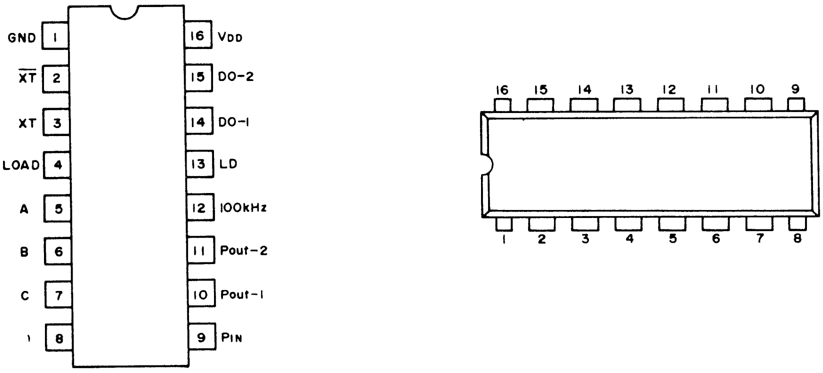

GND 1
$\overline{XT}$ 2
XT 3
LOAD 4
A 5
B 6
C 7
8
16 VDD
15 DO-2
14 DO-1
13 LD
12 100kHz
11 Pout-2
10 Pout-1
9 PIN
16 15 14 13 12 11 10 9
1 2 3 4 5 6 7 8

Figure 35–3

RH-IX1205AFZZ (TC9129P) Block Diagram .... See page 23 (Figure 23–2)

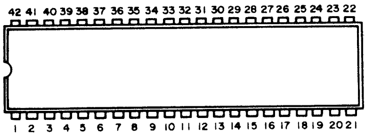

42 41 40 39 38 37 36 35 34 33 32 31 30 29 28 27 26 25 24 23 22
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21

Figure 35–4

VHISN1688PP-1 (SN1688P)

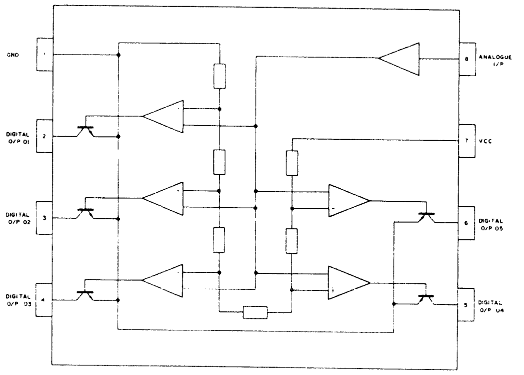

GND
1
DIGITAL O/P O1
2
DIGITAL O/P O2
3
DIGITAL O/P O3
4
8
ANALOGUE I/P
7
VCC
6
DIGITAL O/P O5
5
DIGITAL O/P O4

Figure 36–1

VHITD62301P-1 (TD62301P)

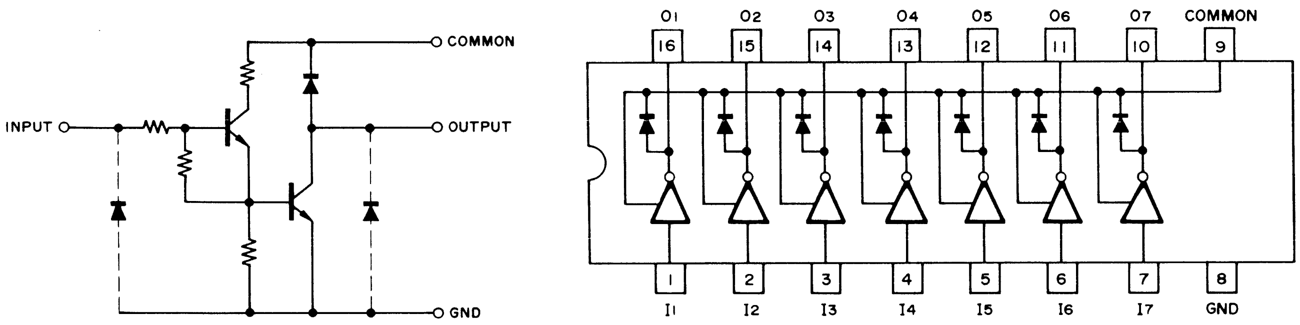

COMMON
INPUT
OUTPUT
GND
O1
O2
O3
O4
O5
O6
O7
COMMON
16
15
14
13
12
11
10
9
1
2
3
4
5
6
7
8
I1
I2
I3
I4
I5
I6
I7
GND

Figure 36–2

VHITC5066BP-1 (TC5066BP)

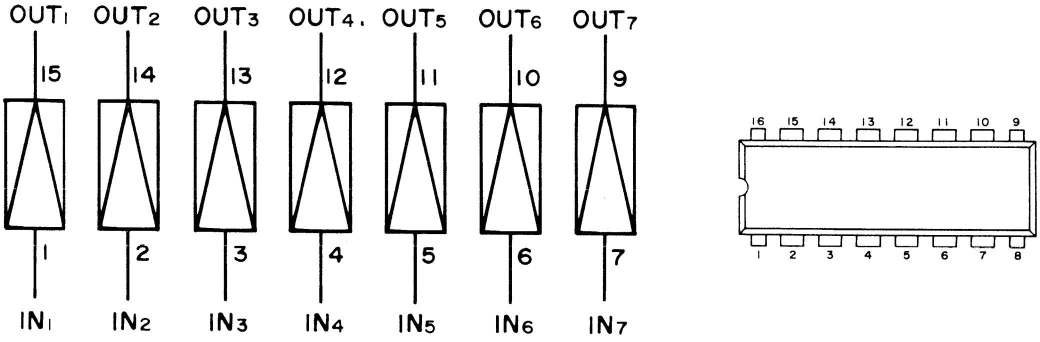

OUT1
OUT2
OUT3
OUT4
OUT5
OUT6
OUT7
15
14
13
12
11
10
9
1
2
3
4
5
6
7
IN1
IN2
IN3
IN4
IN5
IN6
IN7
16
15
14
13
12
11
10
9
1
2
3
4
5
6
7
8

Figure 36–3

VHITC5069BP-1 (TC5069BP)

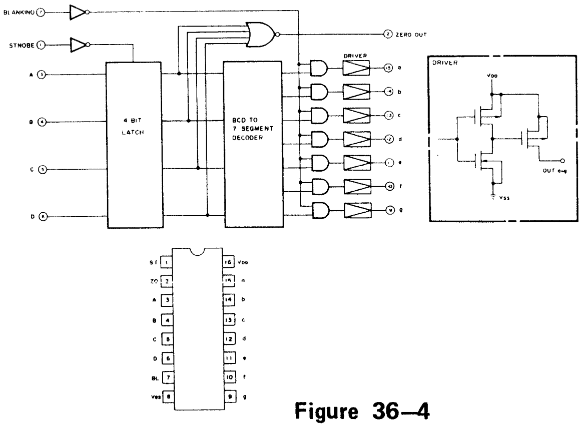
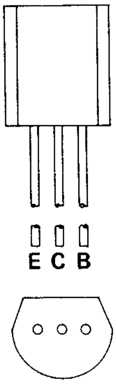

BLANKING 7
STNOBE 1
A 3
B 4
C 5
D 6
4 BIT LATCH
BCD TO 7 SEGMENT DECODER
2 ZERO OUT
DRIVER
15 a
14 b
13 c
12 d
11 e
10 f
9 g
DRIVER
VDD
VSS
OUT a-g
ST 1
ZO 2
A 3
B 4
C 5
D 6
BL 7
VSS 8
16 VDD
15 a
14 b
13 c
12 d
11 e
10 f
9 g

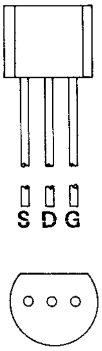
Figure 36–4

TRANSISTORS

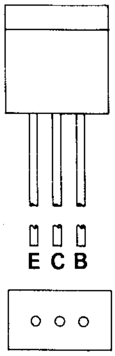
2SA999F
2SC945AP
2SC2320F



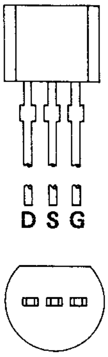
2SK30AY



2SC460B
2SC535C

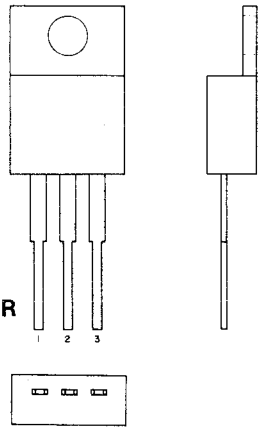


2SC732G
2SC380Y
2SK61Y

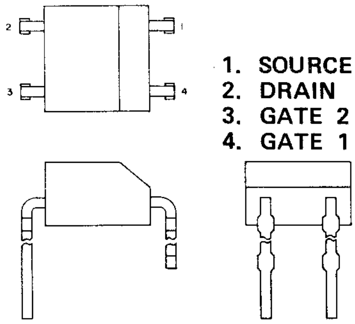


E : EMITTER
C : COLLECTOR
B : BASE
S : SOURCE
D : DRAIN
G : GATE

2SD313

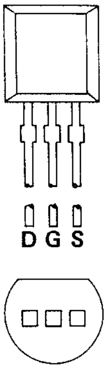


3SK73GR



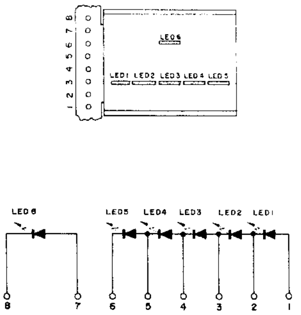
1. SOURCE
2. DRAIN
3. GATE 2
4. GATE 1

2SK106



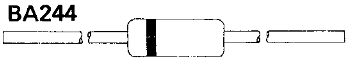
LED Array

SEL8820A


LED6
LED1 LED2 LED3 LED4 LED5
1 2 3 4 5 6 7 8
LED6
LED5 LED4 LED3 LED2 LED1
8
7
6
5
4
3
2
1

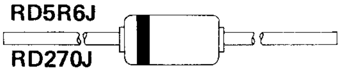
DIODES

ITT543
BA243
BA244



Cathode —|◀— Anode

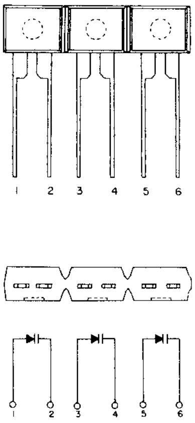
1S2076
RD5R1J
RD5R6J



RD270J

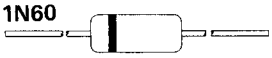
Cathode —|◀— Anode

KV1225


1 2 3 4 5 6
1 2 3 4 5 6

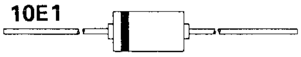
1. 3. 5 : Anode
2. 4. 6 : Cathode

1N60



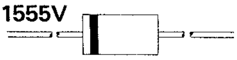
Cathode —|◀— Anode

10E1



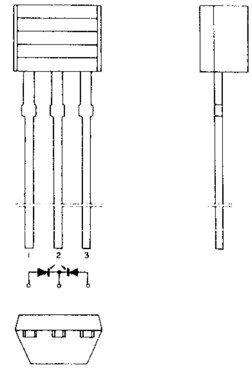
Cathode —|◀— Anode

1S1555V



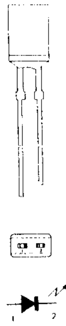
Cathode —|◀— Anode

SVC211SP



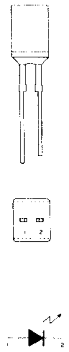
LEDS

GL-9NG12 (Green)

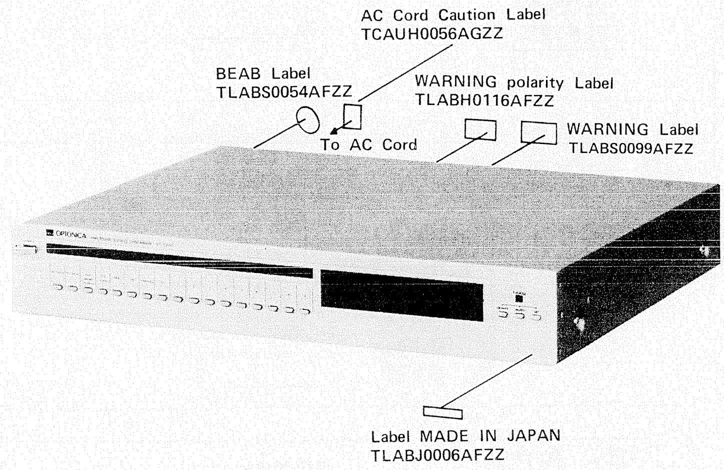


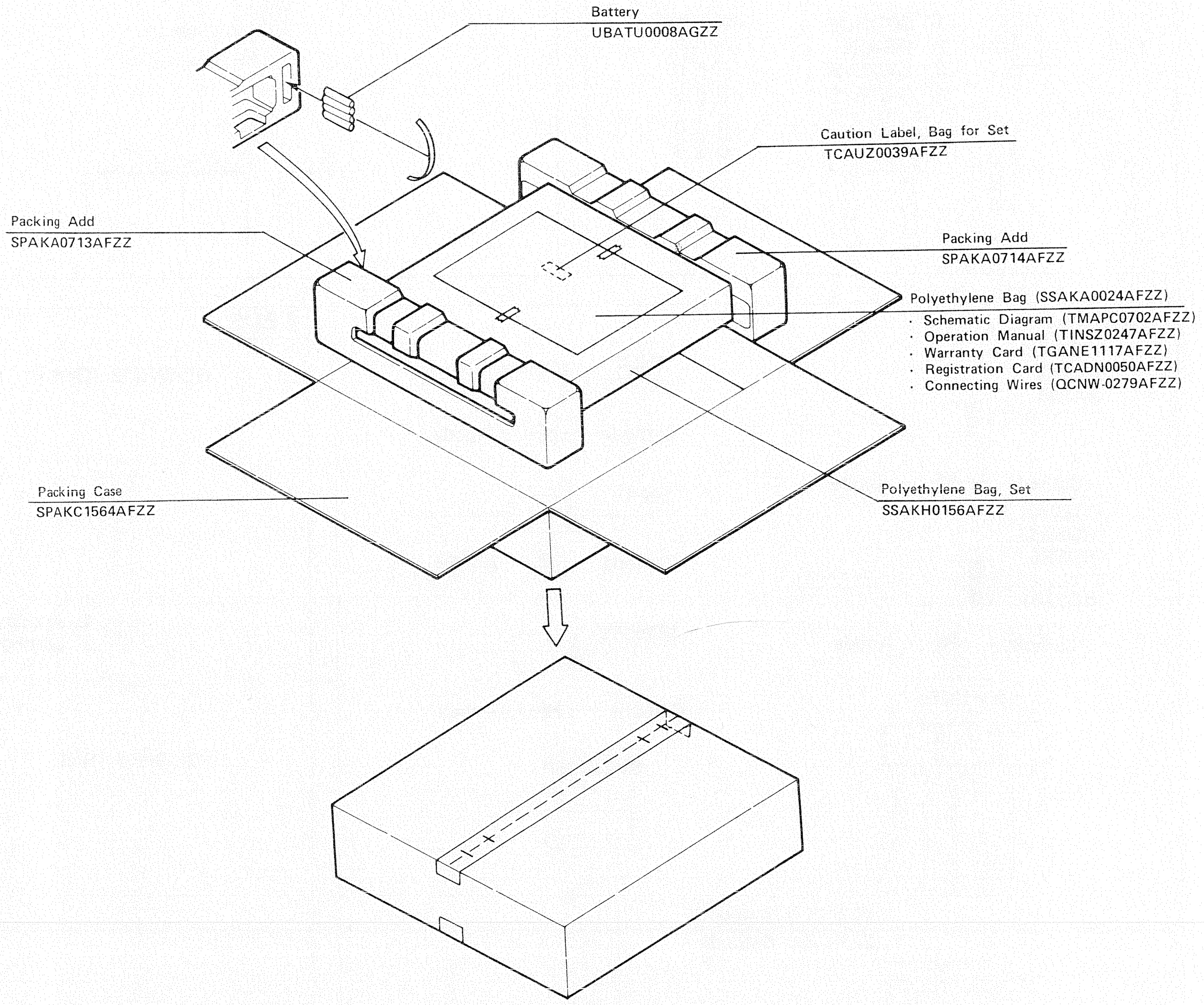
1. Anode
2. Cathode

GL-9PR4 (Red)



■ PACKING METHOD (UK only)


AC Cord Caution Label
TCAUH0056AGZZ
BEAB Label
TLABS0054AFZZ
WARNING polarity Label
TLABH0116AFZZ
To AC Cord
WARNING Label
TLABS0099AFZZ
OPTONICA
Label MADE IN JAPAN
TLABJ0006AFZZ


Battery
UBATU0008AGZZ
Caution Label, Bag for Set
TCAUZ0039AFZZ
Packing Add
SPAKA0713AFZZ
Packing Add
SPAKA0714AFZZ
Polyethylene Bag (SSAKA0024AFZZ)
· Schematic Diagram (TMAPC0702AFZZ)
· Operation Manual (TINSZ0247AFZZ)
· Warranty Card (TGANE1117AFZZ)
· Registration Card (TCADN0050AFZZ)
· Connecting Wires (QCNW-0279AFZZ)
Packing Case
SPAKC1564AFZZ
Polyethylene Bag, Set
SSAKH0156AFZZ

A8012-4.00MNK
Printed in Japan